COMPUTERS IN SCHOOLS

A STRATEGIC PLANNING SYMPOSIUM

January 29-31, 1986

Edmonton, Alberta

Sponsors:

Alberta School Trustees' Association
Alberta Teachers' Association
Alberta Teachers' Association Computer Council
Grande Prairie School District
Media and Technology Branch, Alberta Education

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Sponsored by:

Alberta School Trustees Association
Alberta Teachers Association
Alberta Teachers Association Computer Council
Grande Prairie School District #2357
Alberta Education
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STRATEGIC PLANNING SYMPOSIUM

January 29, 30 & 31, 1986

February 3, 1986

Dear Reader:

Since the release of the Ministerial Task Force on Computers in Schools report, major developments have occurred in educational computing. From a hardware perspective, current estimates would seem to indicate at least 23,000 microcomputers in schools in the Province. Yet computer hardware is but one component of a successful implementation of computers in schools. Quality educational software and teacher knowledge are also required if the investment in computers is to be fully realized. Also, it is recognized that the focus of educational computing has shifted from initial computer awareness to the integration of computers into the classroom.

With the recognition that a reassessment of educational computing was required, a committee composed of representatives from the Alberta Teachers' Association, Alberta Teachers' Association Computer Council, Alberta School Trustees Association, Grande Prairie School District, Alberta Education and the University of Alberta began the process of designing a strategic planning event. Late in 1985 school jurisdictions, active in educational computing, were invited to attend a Strategic Planning Symposium set for January 29 - 31, 1986 in which the participants would be given an opportunity to identify issues and make recommendations in one of nine working group areas.

This report is a result of the labours of approximately 160 of the invitees and represents a collective vision of where we are and what needs to be done. I am very pleased with the results of the Symposium and I am hopeful that the recommendations contained herein are beneficial to those entrusted with the task of making educational computing a success.

Sincerely

John Travers

John Travers
Chairperson
Strategic Planning Symposium
Planning Committee

FOREWORD

It takes a great deal of time, effort, finances, planning, and even some good luck to organize and conduct a two-day symposium which brings together over 160 persons from across Alberta who are involved with different aspects of Alberta's schools. Much of the attendees' time at the symposium was spent in one of nine different working groups discussing issues and problems related to the future of instructional computing in Alberta schools, formulating solutions and recommendations to the issues, and producing a written version of their deliberations.

A great deal of the credit for the success of the symposium should go to the Symposium Planning Committee which met periodically over a period of six months, usually by conference telephone. The Planning Committee consisted of :

- John Travers (Symposium Chairman; Associate Director, Computers in Schools, Alberta Education)
- Rick Bell (President, Alberta Teachers' Association Computer Council)
- Eunice Easton (Computer Facilitator, Grande Prairie School District)
- Dale Erickson (Executive Assistant for Educational Services, Alberta School Trustees' Association)
- Bill Leslie (Trustee, Grande Prairie School District)
- Milt Petruk (Professor, Faculty of Education, University of Alberta)
- Janitt Strachan (Symposium Coordinator)
- Derek Taylor (Superintendent, Grande Prairie School District)

The original written work was done on-site, at the symposium, using nine Macintosh computers which were connected to an Apple Laser Printer using the AppleTalk network.The written material from the nine working groups was then forwarded to me for reformatting and editing. Care was taken to ensure that the integrity of the working group reports was maintained in this final report.

Gene Romaniuk

Editor and member of the
Symposium Planning Committee

March, 1986

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INTRODUCTION

The initial commercial introduction of fully assembled microcomputers took place in 1977 - just nine years ago. Not long after that, educators began to show interest in using microcomputers in schools. By early 1981, there were approximately 265 microcomputers being used in Alberta schools. In October, 1981, the Honourable David King, Alberta's Minister of Education, announced the creation of a Computer Technology Project. This was the beginning of a coordinated commitment by Alberta Education to facilitate the introduction of microcomputers into Alberta schools. In his 1981 announcement, Mr. King predicted that within three years there would possibly be upwards of 20,000 microcomputers installed in Alberta schools. The forecast of such a large number of microcomputers was viewed as an impossible dream by many educators. How could Alberta schools possibly acquire 20,000 microcomputers in the next five years, when it took almost four years to purchase the initial 265 microcomputers? It would never happen! The critics were correct, instead of three years it took four years to reach King's forecast. Already more than 20,000 microcomputers have been installed in Alberta schools and all indicators point to over 30,000 installed microcomputers by the end of 1986.

Five years ago it was difficult for educators to make any long range plans for instructional computing because, in general, they lacked experience with and information about this rapidly emerging and changing technology. Now, many educators feel they have enough experience with which to attempt to face, and solve, some of the major issues related to educational computing. To this end, a Strategic Planning Symposium which focussed on nine major issues in educational computing was held in Edmonton, Alberta, January 29-31, 1986. The Symposium was initiated and largely funded by the Grande Prairie School District #2357, Alberta Education, Alberta Teachers' Association (ATA), Alberta Teachers' Association Computer Council (ATACC), and the Alberta School Trustees' Association (ASTA). Corporate sponsorship was provided by Apple Canada and IBM Canada. Approximately 160 persons from invited Alberta school jurisdictions, Alberta Education, and Alberta's universities attended the Symposium. Representation included school system personnel (computer consultants, financial personnel, principals, teachers, trustees, and superintendents), officials from Alberta Education, and the deans (or their designates) from the Faculties of Education at Alberta's universities. Guest speakers at the Symposium included David King (Minister of Education), John Hebden (Apple Canada, Toronto), Harvey Long (IBM, Boca Raton, Florida), and David Moursund (University of Oregon).

The Symposium attendees were assigned to one of the following nine working groups:

1. Designing and equipping instructional facilities.
2. Software/Courseware evaluation, development, and acquisition.
3. Teacher Development.
4. Instructional networking.
5. Wide-area networking.
6. The integration of computers into the elementary curriculum.
7. The integration of computers into the secondary curriculum.
8. Administrative uses of computers.
9. The use of computers in business education.

Each group consisted of a group leader, up to two expert consultants, and approximately 12-15 other attendees. During the assignment of attendees to the working groups, an effort was made to ensure that no more than one attendee from any school jurisdiction was assigned to any specific working group, and that each working group was composed, where possible, of at least one member from each of the following categories: Alberta Education, computer consultant, teacher, school board financial administrator, school board trustee, and school superintendent.

After two days of deliberations, each working group formulated a number of issues, solutions and recommendations regarding their area of concern. Below is a set of **six major recommendations**, which represents a synopsis of the recommendations of the working groups. For more detailed descriptions, rationale, and recommendations which represent the activities of the individual working groups, the reader is directed to each of the nine chapters which follow.

1. **Planning and Leadership :** That strategic planning be an ongoing process. A suggested approach is the development of a five-year plan, which would need constant monitoring and adjustment due to rapid technological change, increasing experience by educators with educational computing, and the increasingly large base of research findings that is being accumulated. To provide the mechanisms for facilitating accurate planning requires bold, innovative, and decisive leadership by respected educators who are knowledgeable about and competent in using educational computing. A group of such leaders should be selected from most of the major stakeholder groups in Alberta schools to assist the Minister of Education in designing, monitoring, and adjusting a long range plan for educational computing. The Media and Technology Branch should be assigned the responsibility for assembling this group and for implementing the major recommendations of this Planning Symposium.

2. **Funding :** That there be continued support for the acquisition of computers across all segments of Alberta schools. As well, support is required for :

   - courseware/software licensing, acquisition, and development,
   - teacher inservice, and preservice and graduate training in educational technology, and
   - research into various aspects of instructional and administrative implications of using educational technology.

3. **Communications :** That policies and guidelines be formulated to promote the sharing of information. Because of the rapid changes occurring in educational computing, many projects and evaluations are being conducted, and the number of data-bases is growing rapidly. Much of this information can be electronically accessed. Thus, care must be taken to ensure that all educators and students have **equal access** to a telecommunications system that is both low-cost and is easy to use. To encourage sharing of information, emphasis should be given to funding experimentation with and installation of local area (classroom and school) network and telecommunication related hardware and software. Also, there is an immediate need for **uniformly low telecommunications rates** for schools throughout Alberta.

4. **Technological Learning Resources :** That the role of the Clearinghouse should be expanded to include more than its function of evaluating a restricted range of courseware/software. There is a need to evaluate emerging technologies to identify those which have potential for application to instruction. In addition, Alberta Education should identify areas within the Alberta programs of studies that could be better served by computer-assisted techniques, but which are not currently being addressed by commercial products. Products which need to be developed to fulfill this need could be contracted to the private sector.

5. **Training and Inservice :** Because of the very rapid changes occurring in educational computing, funds and resources must be provided to inservice those teachers already using available computing technology, as well as to furnish introductory inservice to those teachers who have not yet used computers, but who wish to learn how technology could be effectively used in the instructional process.

6. That a **Planning Symposium**, such as this one, be convened every two years to review developments which have occurred since the last Symposium and to modify and reformulate the long range plans for use of educational computing in the schools.

I. DESIGNING AND EQUIPPING INSTRUCTIONAL FACILITIES

A. PARTICIPANTS

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B. INTRODUCTION

In designing and equipping instructional facilities, it is recognized that many variables enter into decisions that are made at the school and district levels. Use of technology in a variety of subject areas and grade levels in different organizational structures leads to difficulty in defining one set of recommendations to fit all situations.

Major issues in designing and equipping instructional facilities were identified as falling within two major problem areas :

- Planning considerations, and
- Design considerations.

Two documents that are included as appendices to this report provided substantial information regarding both problems. The two documents are :

- *Planning and Designing School Computer Facilities,* Edmonton: Alberta Education (School Buildings Services Branch), Interim Report, November, 1985.
- John E. Percevault, *Designing and Equipping Instructional Facilities*, January, 1986.

C. PLANNING CONSIDERATIONS

1. Issue and Solution Identification

Several issues were identified in the area of planning considerations:

- Who should be involved in the planning process?
- How can plans for adequate facilities be designed when we are unsure of the overall direction of educational computing?

- Is there a difference in planning new facilities and renovating existing facilities?
- How can all end users of the instructional computing facility be satisfied?
- How do curriculum requirements and grade levels influence the way in which instructional facilities are designed?
- What philosophical orientations need to be considered in designing instructional computing facilities (e.g., teaching style, role of the facility)?
- How are the locations of computer facilities determined?
- Can a planning model be used to aid in decision-making?

2. Recommendations

- ***That schools and school jurisdictions reference the planning model outlined in Alberta Education's interim report (p. 2).***
- ***That schools recognize and consider differences in emphasis in planning new facilities as opposed to renovating existing facilities. Input from the end user is vital in the planning process.***

D. DESIGN CONSIDERATIONS

1. Issue Identification

Because it is recognized that there are several alternatives in organizing for instruction using computer technology, design considerations were identified for configurations in a continuum put forth by Percevault (p. 2). The configurations included three major areas:

- no lab
- carts in a lab
- fixed stations within a lab

Design considerations were priorized within each configuration by use of a matrix (below). Participants assigned 20 points to design considerations within each column. Horizontal totals indicate the overall relative importance of each design consideration.

Four major design considerations were considered as priority areas to be addressed:

- Workstation Design (296)
- Space (247)
- Electrical/Mechanical (211)
- Layout (174)

The two documents used as reference throughout the discussion address these design considerations to some degree. It is recognized that examples of plans put forward in the Alberta Education's interim report would require modification for each school situation.

Design Consideration	Assigned Micro/Class	Mobile Carts	Floppy Disk	File Server	Stand Alone	Network System	Total
Access	15	17	22	14	17	17	**102**
Environment	19	19	21	16	20	22	**117**
Lighting	25	20	17	19	23	23	**127**
Security	22	25	21	20	17	15	**120**
Storage	12	17	23	14	17	17	**100**
Electr./Mechan.	30	34	37	38	37	35	**211**
Space	47	39	40	35	41	45	**247**
Layout	24	16	28	28	37	41	**174**
Location	15	22	20	17	20	14	**108**
Communications	20	17	14	23	24	24	**122**
Workstation	47	52	52	51	47	47	**296**

Therefore, recommendations were made regarding the above priority areas.

2. Recommendations

a. Workstation Design

- **BQRP (Building Quality Restoration Program) funds for equipment and furniture should be extended throughout the ECS - 12 segments of the education system.**
- **BQRP funding should be expanded to include the general program.**
- **Research on the workstations used by students should begin immediately, leading to several designs that would address different variables.**

- Demonstration workstations and prototypes should be created and field tested in pilot projects. It is recognized that although it may be only practical to consider a five year future use of these workstations, schools may continue to use the design for several years afterward.

- The collection, evaluation, and sharing of information regarding student workstations should begin at the provincial level in order that schools and school jurisdictions might adjust existing plans to suit their own needs.

- Designs must be flexible in order to accommodate future additions or changes in hardware and instructional needs.

b. Space

- School building regulations should be modified and updated, particularly in reference to computer use outside the area of business education. As the number of computers within schools increases, there is a need for more space.

- Any increases in space for instructional computing should not increase the capacity of the school. Space dedicated to computer use should not count as part of the utilization space, whether it takes the form of a computer laboratory or is an extension of the regular classroom.

c. Electrical/Mechanical

- Research into mechanical requirements should be promoted to allow computer areas to operate at acceptable standards; this includes guidelines for air quality, temperature, and humidity.

- Power supply requirements should be analyzed to determine power quality on an individual school basis.

- There must be recognition that funding is necessary for adequate electrical servicing of instructional computing areas.

d. Layout

- Research on designs for layout of computer facilities is necessary. Prototypes should be field tested and evaluated, incorporating a variety of teaching modalities.

- **Information on designs for layout should be collected, evaluated and disseminated on a province-wide basis.**

e. Other Areas

- **A study, similar to that described in Table 3 of Alberta Education's interim report, should be conducted in Alberta schools to determine settings in which computers can best benefit the educational program.**

- **A model policy that could assist local schools with requirements and needs in the area of security should be drafted by Alberta Education.**

- **There is a requirement for research to address the ramifications of computer use in schools with regard to health considerations.**

II. SOFTWARE/COURSEWARE EVALUATION, DEVELOPMENT AND ACQUISITION

A. PARTICIPANTS

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B. ISSUES AND PROBLEMS IN COURSEWARE/SOFTWARE EVALUATION AND SELECTION

- Many local jurisdictions are involved in evaluation, selection, and/or approval of software. There is a need to share the results of this process with all jurisdictions in Alberta.
- To help the decision making process at the local jurisdiction level there is a strong need to conduct more evaluations in a shorter time frame.
- Criteria for the evaluation of CAI type software is generally available and well used. This is not necessarily the case for productivity tool type of software.
- In addition to information available from evaluations by trained evaluators, there is a need for more information based on use of software/courseware in actual classroom instructional situations.
- Besides disseminating information on potentially useful software, there also exists a need for an opportunity to preview or try the software to ascertain its suitability or applicability to the local situation.
- There continues to be a very real concern about the lack of quality software to fill a wide range of needs.
- Business education departments of high schools are beginning to move toward the use of IBM software . There is a feeling of concern about the policy of Alberta Education toward the types of formats it will support. It is felt that all potentially useful IBM PC software should be evaluated, not just IBM versions of Apple software.

- The Alberta Education Clearinghouse should begin to concern itself with the evaluation of all kinds of learning resources, rather than just restricting its efforts to computer software/courseware.

- There needs to be more dissemination of information on the appropriate use of software. That is, in addition to identifying potentially useful or recommended software, it is important to share information regarding how, when, and where to use that software in the curriculum.

C. POTENTIAL SOLUTIONS

- Alberta Education needs to collect information from those school jurisdictions that are evaluating and using software and disseminate the information gained from that experience to all other school jurisdictions.

- Alberta Education should invest more funds in software/courseware evaluation.

- Software should be purchased, used in classrooms, and the results of that experience or field test reviewed as part of the evaluation of each piece of software.

- Alberta Education should establish an on-line bulletin board to disseminate the information gathered in the above item. The total cost of hardware, software, and communications capabilities should be supported or subsidized by Alberta Education.

- Alberta Education should assist school boards in the identification of useful software by establishing regional software preview/loan libraries. The purpose would be to allow software to be borrowed for preview purposes by individual schools. A concern exists, however, as to the potentially excessive cost of this option because of the number of copies of each piece of software that would be necessary.

- After an initial screening and the identification of those pieces of software that appear to have some potential use, these should be tested in a classroom situation. This kind of field test, or actual classroom use, is very important but may not prove to be a final solution because every jurisdiction or school wishes to make an evaluation of the potential of a piece of software to meet the needs of its students.

- Alberta Education should endeavour to undertake a province-wide training program to establish a network of software "screeners" to identify packages with some potential for the classroom. This information should then be rapidly disseminated to all jurisdictions. Thorough evaluation would not be required at this point. That could happen when the question arises as to whether or not to "recommend" a package.

- Alberta Education should redefine the various categories of software approval in order to establish additional categories to enable school boards to obtain greater price discounts for non-basic or supplementary software.

- Software/courseware for the IBM and Apple micros should be evaluated without regard as to whether or not the particular package is available in both the IBM and Apple formats.
- The mandate of the Clearinghouse should be expanded to include all learning materials. This would provide more comprehensive evaluation information to the schools.

D. ISSUES AND PROBLEMS IN SOFTWARE ACQUISITION

1. Copyright

- Pricing of software, especially productivity/business software, needs to be more reasonable for classroom use than it is for production/business use.
- Who owns the copyright to software developed by a teacher as part of his/her duties or in his/her spare time using school owned equipment?
- What actions need to be taken in order for appropriate authorities in a school district to feel they have exercised their responsibilities for the dissemination of information and the supervision of copyright protection?
- We need to ask ourselves whether stronger support for copyright protection by educators will reassure publishers enough so that publishers are willing to place more effort into the development of better quality materials, at a lower cost.
- Technological advancements are generally making it easier to copy all kinds of materials (print, video, software, etc.) and making the whole issue of copyright a very current and visible one that is not likely to die a slow death. Impending revisions to the Copyright Act also draw attention to activities related to possible copyright violations.
- There is a need for the dissemination of information related to the use of excerpts (text, video, software, etc.) in the classroom.

2. General

- School jurisdictions need to revise their budget priorities appropriately to meet the needs that have come about and are growing for the acquisition of software.
- We need to ask if we are putting enough money into the purchase of educational materials to support the instructional process.

- Costs are a concern:
  - cost/student
  - class sets
  - licenses for productivity tools and CAI
  - site and provincial licenses

- Licensing means different things to each producer. For example, the MECC license is an annual license and both MECC and SRA sell the licensee the right to use the materials, but not the right of ownership to the software.

- Obtaining a license can create problems related to duplication of discs and documentation.

- If the School Book Branch gets too involved in the supply of supplementary materials, it might create concern in the private sector by trying to compete with their prices or be viewed as encroachment into private business. Also, the logistics related to replacement, warranties, etc., could significantly increase the workload of the School Book Branch.

- Software producers have only recently begun to address the issue of licensing and quantity pricing for education.

- Replacement of discs can become a real problem of logistics and workload for those cases where discs wear out, are damaged, need to be updated, or when new versions are produced.

3. Possible Solutions

- Direct grants from Alberta Education. But what do we do when the grants stop? If the grants continue in smaller amounts over a long period rather than large amounts over a short term, it is more feasible to expect schools to keep their software collections updated.

- Increase bulk purchasing of software by the School Book Branch and pass the savings to local boards and schools.

- Local bulk purchasing to get discounts.

- In the case of "basic" resources, negotiate provincial licenses at prices advantageous to schools.

- Alberta Education should exert pressure on producers to get lower educational prices by listing only those items which are available at reasonable prices.

- School districts should assess their budget commitments regarding the purchase of software.
- An establishment of electronic networks for the distribution of software is one solution. This might work in the case of provincially developed software, but creates some problems for policing unauthorized access outside the province. Nonetheless, investigation should begin now.
- Networking at the classroom level may be a long term solution, but not much software is yet available which can be implemented on networks.
- Negotiations should proceed directly with Apple and IBM for educational pricing of their software.
- Some agency, such as the Clearinghouse or ACCESS, should act as an agent to obtain licenses and distribute updates and information.
- Charge the Clearinghouse with the task of evaluation and ACCESS with the task of negotiation, acquisition, and distribution of software.
- Don't treat software differently from other learning resources, but integrate it into the operations of agencies now dealing with other learning resources. When disks fail, for example, they could be returned to the agency that distributes the materials, just as faulty video tapes are handled now.
- Alberta Education should begin negotiations with the software publishing companies to obtain standard warranty and replacement policies.

E. DEVELOPMENT ISSUES

- Education must establish software quality standards and identify areas of the curriculum where software is needed.
- Alberta needs to investigate the feasibility of translating to the Apple or IBM format appropriate software developed in Ontario.
- A model needs to be established for software development in the province. A number of models exist including the Ontario Ministry model, MECC, the ACCESS video model, and the Alberta textbook model.
- There is need for a vehicle to handle procedures for development of software by individual teachers or school jurisdictions.
- Rapid technological development will always affect software development and the rate of obsolescence of software.

- There must be a financial return to the developer.
- Software development should have a research component attached to it.
- Who will pay for software development?
- Classroom teachers should be involved in identifying appropriate guidelines for the design and development of software.

F. POTENTIAL DEVELOPMENT SOLUTIONS

- Ad hoc committees of Alberta Education need to develop lists of needs and design guidelines. These committees could also begin to identify those things that computers do better than other media.
- An agency based on the ACCESS model should be established to develop computer software. The Canadian Centre for Learning Systems in Calgary is an example of a possible agency.
- Alberta Education should investigate a number of different models for computer software development including the Ontario Ministry model where software development is contracted to the private sector. The Ontario Ministry retains ownership of the software and TV Ontario distributes it.
- Look to the BBC/Acorn software model for ideas regarding development guidelines.
- Alberta Education could search out teachers with software design expertise and create production teams which would include programmers.
- Alberta Education should take a leadership role in encouraging software development.
- Alberta Education should search out existing materials and encourage individual teachers and school jurisdictions to submit their design ideas.
- Funding by Alberta Education could lead to the development of software to meet current needs, reduce costs to local schools and encourage the development of local industry.
- The Planning and Research Branch should undertake and facilitate research related to software development and field testing.
- The Curriculum Branch should undertake activities related to the development of integrated learning resources that include software as a component.
- Shared funding, as in the BQRP model, seems to work well, and has been well received.

G. RECOMMENDATIONS

In developing its recommendations, working group II tried to identify some major trends or themes. It felt that many of the recommendations were already well expressed in the identified potential solutions.

1. Evaluation and Selection

    - ***That the mandate of the Clearinghouse be expanded as identified in this report.***
    - ***That increased attention be given to improved means of communication, such as on-line bulletin boards and preview centres.***
    - ***That assistance be provided to local evaluation centres.***

2. Acquisition

    - ***That there be increased funding assistance for software acquisition.***
    - ***That there be investigation of ways and means to assist schools to obtain more software at reasonable prices. These ways and means might include such things as site licenses, provincial licenses, bulk purchases, and provincial development efforts.***

3. Development

    - ***That Alberta Education ensure that adequate, quality software development appropriate to the Alberta curriculum begin through an appropriate model, under suitable design guidelines, and with sufficient funding. This development effort should include an appropriate research component.***

4. General

    - ***That the emphasis of Alberta Education's funding effort for instructional computing be shifted from hardware to software.***
    - ***That strategic planning for computers in education should be an ongoing process with an annual review involving both Alberta Education and local jurisdictions.***

- ***That Alberta Education establish a five-year plan for integration of computers into the instructional process.***
- ***That Alberta Education establish lighthouse schools for all levels of ECS-12, with emphasis upon research into appropriate use of technology to enhance instruction.***
- ***That Alberta Education immediately establish methods to communicate information to schools on all aspects of technology in education.***

III. TEACHER DEVELOPMENT

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B. INTRODUCTION

The group recognizes that the problems and issues of teacher development are impossible to separate from those raised in the other working groups of the Symposium.

Throughout this document, reference to teacher development assumes both a preservice component and an inservice component.

C. THE PROBLEM

1. How is teacher development best accomplished?

2. What factors are most important in assuring successful integration of technology into the educational system?

D. ISSUES - in order of priority

1. Goals of teacher development - We need a clear direction of the goals of teacher development. We need a plan (provincial, district, school). What should teachers know? General effective teaching strategies (including use of technology)? Awareness of computer capabilities for instruction and as a personal tool? Evaluation and selection of software, and how to integrate software into instruction? What does the research literature indicate? What are the general goals of preservice training? Should we be teaching teachers to be independent, flexible, and adaptable learners rather than limiting them to a 'narrow skill set'? How do we define 'awareness', 'curriculum', 'literacy', 'inservice', and 'professional development'?

2. Delivery - How is teacher development best delivered? When? By whom? Which model(s) of inservice are most effective? Should teacher development be proactive or

reactive? How far along the leading edge should we be? Are there ways of sharing expertise and information throughout the province? Time is a critical factor (for the teacher and the teacher educator). How can diverse educational programs (preservice, inservice) be offered to teachers as well as students? How does teacher development affect attitudes toward the computer as a legitimate, relevant educational tool? Are support groups and follow-up sessions to inservice a necessary component of teacher development? How can we overcome scarcity of human and material resources?

3. Change - Technology, teacher development needs, and curriculum are changing rapidly. Teachers, teacher educators and their institutions must develop mechanisms to cope with and incorporate rapid change for the foreseeable future. Can we pause to evaluate our current position. Where we are going? Will new jobs/responsibilities within the school affect teacher development needs (e.g., computer coordinators, teacher librarians, aides and technicians)? Will the curriculum be transformed because of technology? Should curriculum revision precede teacher development?

4. Inequities - Inequities of resources (human, material, equipment, opportunity, monetary) : rural/urban inequities; small/large school boards.

5. Stakeholders - What roles and responsibilities do the stakeholders in education have in order to ensure the success of teacher development efforts (teachers, principals, curriculum specialists, superintendents, trustees, parents, colleges, universities, community members, politicians)? How can all teachers develop an awareness, 'see what they have to know'? Who really effects change - the teacher or the administrator (principal or central services)? Is ongoing lifelong education the personal responsibility of teachers?

E. TERMS OF REFERENCE

1. The goal of teacher development is to assist in the acquisition of skills, knowledge and attitudes such that each teacher can achieve the goals for student learning. The characteristics of an ideal teacher can be identified and minimum standards can be set. This ideal teacher is the goal of teacher development.

   a. Profile of the "ideal" teacher

      - Applies various effective teaching strategies
      - Integrates and incorporates computer technology into the learning environment
      - Uses technology as a personal productivity tool
      - Based upon sound pedagogy, creates a learning environment for exploration and discovery
      - Demonstrates flexibility

- Is an independent, lifelong learner
- Is a co-learner with students
- Facilitates rather than directs learning

2. Teacher development is a valuable activity for school districts, schools, teacher educators, and teachers.
3. Teacher development must be based upon a strong theoretical base of student learning.
4. It is better to facilitate than to legislate teacher development.
5. Teacher development must be varied (e.g., strategies, levels, resources, etc.).
6. Teachers and teacher educators must have access to computer resources when they need them, for as long as they need them.
7. Teacher development should include a sharing of human and material resources at all levels (classroom, school, district, provincial).
8. The responsibility for teacher development rests with many stakeholders (teachers, administrators, trustees, teacher educators, politicians). Goals must be set at all levels.

F. RECOMMENDATIONS

- ***Preservice education programs must include experiences leading to a user knowledge of computer technology for educational purposes.***
  provincial: certification standards.

- ***Preservice programs must support and encourage the integration of computer technology within university courses.***
  provincial: mandate to post-secondary institutions.

- ***Resources be allocated to provide for a variety of teacher and teacher educator release experiences .***
  school: professional development funds within school budgets.
  district: sabbatical leaves; secondments; adequate funding for professional development.
  provincial: continuation of teacher inservice funding.

- ***Mechanisms be established to facilitate sharing of resources at all levels.***
  school: lesson plans among teachers; classroom visitations.
  district: curriculum development support; school intervisitations.
  provincial: electronic networking of educators; incentives for sharing of resources among districts.

- ***Teacher educators be provided with resources to carry out effective teacher development programs.***
  - *school:* *allocate time.*
  - *district:* *funding priority; allocate time.*
  - *provincial:* *curriculum guides and materials; response centres; continuation of teacher inservice grants; documents outlining inservice models; database of resources; allocate time.*

- ***Establishment of resources for school administrators to enable them to implement the integration of computer technology for educational purposes.***
  - *district:* *consultants; model schools; incentives to visit other schools; models of inservice, setting goals, evaluation of programs; strategies for organizing for instruction.*
  - *provincial:* *models of inservice, setting goals, evaluation of programs.*

- ***Methods should be pursued to provide all educators with computer resources for individual professional development when they need them, for as long as they need them.***
  - *school:* *weekend and summer loans.*
  - *district:* *policies that accommodate out of school use of these resources .*
  - *provincial:* *tax incentives; subsidies; providing a computer for each educator.*

- ***Educational computing must be a priority of educational research.***
  - *school:* *encouragement of experimentation and innovation by classroom teachers.*
  - *district:* *sabbatical leave priorities; release time for research; pilot projects; secondments .*
  - *provincial:* *research grants; post-secondary institutional incentives.*

IV. INSTRUCTIONAL NETWORKING

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B. PROBLEM STATEMENT

The stand-alone configuration of microcomputers limits the potential benefit that can be derived from the use of computers in instruction. This Symposium urges educators to consider interconnecting groups of microcomputers in local area networks (LANS). Clear direction should be provided to teachers and administrators in Alberta schools concerning the use of local area networks in classrooms .

This working group recommends ***that school jurisdictions adopt networking of microcomputers in classrooms as a goal.***

C. BACKGROUND

A local area network (LAN) is a means by which a group of microcomputers can share resources such as software, mass storage, and printers. It consists of a dedicated file server, mass storage device(s), printer(s), interconnected microcomputers, and network software. Network software provides the means to share resources through file serving and, in that sense, is relatively independent of the actual hardware involved.

Instructional classroom networks have several advantages over stand-alone configurations. The advantages are:

1. Management of instruction is enhanced. Distribution and security of software is centrally controlled by the file server. Many different software packages can be used simultaneously without any attendant administrative difficulties.
2. The instructor can effectively direct software use at particular work stations.
3. Software costs are potentially cheaper . A multi-use licensing agreement is potentially less expensive than the current legal requirement to purchase one copy of a software package for each microcomputer in a lab.

4. The system is more reliable because hard disc storage devices are engineered to very high tolerances, and work with commonly troublesome floppy drives is minimized.

5. As more and better software becomes available, individualized instruction may be truly realized.

6. As advanced networking software becomes available, interactive, cooperative learning may take place on a large scale.

There are some disadvantages to the use of classroom networks. Many of these disadvantages will likely be alleviated in the future. Below is a list of some of the disadvantages :

1. Greater technical expertise is required of the teacher. The operation and maintenance of networks can be complex and time consuming.

2. When the system goes "down", the entire network can be affected.

3. The network can be slow when user demand is heavy, such as at the end of a class, or when the software in use requires a high degree of input/output activity.

4. Usually software must not be protected in order to be copied to a hard disc. This requirement must be fully addressed when licensing agreements are drawn up.

5. The licensing of software is probably the most critical problem with classroom networks in the short run.

D. ISSUES

As soon as the concept of networking microcomputers for the purpose of instruction is endorsed, a number of issues must be considered. These issues embrace such aspects as software, hardware, system management, and instruction.

- software : licensing, networkability
- hardware : ease of networkability, speed of data transmission
- system management : ease of operation, maintenance
- instruction : classroom management, instructional techniques

Many of these issues involve an expanded leadership role for Alberta Education.

E. LONG RANGE ISSUES

1. Policies and guidelines at the provincial level are essential for instructional networking.

Recommendation: ***That Alberta Education establish policies and guidelines for implementation and utilization of classroom networks.***

2. The benefits to be derived from instructional networking should be universally available.

   Recommendation: ***That Alberta Education establish a cost sharing program with local jurisdictions to provide the human and physical resources necessary for implementing local area networks in classrooms.***

3. Research is necessary to maximize the benefits of instructional networking.

   Recommendation: ***That Alberta Education support research to determine how to maximize the benefits to be derived through instructional networking.***

   - *research regarding effective facilities planning*
   - *research regarding instructional strategies at the classroom and wider school level*
   - *future, when fully interactive networks are available*

4. There is a need for effective, networkable software.

   Recommendation: ***That Alberta Education provide support for the development of appropriate software.***

   - *incentives are required to encourage local developers to produce software*
   - *an agency, similar to ACCESS, should be established to fund and develop the required software*

F. IMMEDIATE ISSUES

1. Installation of networks will have some impact on instructional strategies.

   Recommendation: ***That time and direction be provided to allow for the adaptation of instructional strategies. Consultants or the required funds for consultants should be provided.***

2. The selection of hardware is critical.

   Recommendation: ***That jurisdictions consider networkability as an important criterion for the choice of hardware.***

   - *information must be made available on a province-wide basis*
   - *funding is required for research about networking software*

3. Networkable software is relatively unavailable.

   Recommendation: ***That Alberta Education pursue strategies for making effective, networkable software available at reasonable cost.***

   - *Establish agreements with developers for site licenses*
   - *Low cost software is required*

4. Trustees, administrators, teachers, and the general public are relatively unaware of the advantages and disadvantages of implementing classroom networking .

   Recommendation: ***That Alberta Education provide leadership by promoting increased awareness of the benefits to be derived from instructional networks. Information could be distributed through publications and news releases.***

5. There is a need for network management support and educational leadership at the school level.

   Recommendation: ***That local jurisdictions recognize and provide for sufficient human resources to meet these needs.***

   Three levels are envisaged :

   - *System manager : care and maintenance of networking, handling minor technical crises, and custom programming.*
   - *Computer coordinator : in addition to the above duties, software evaluation, technical and instructional help for teachers.*
   - *Learning resources person : in addition to the above duties, curriculum responsibilities, time and expertise to encourage the integration of computers into core subjects.*

6. Teachers will require training in the effective use of networks.

   Recommendation: ***That preservice and inservice programs be developed.***

   - *Universities should provide model instructional computing facilities and require computing courses as part of the B.Ed. program.*

   - *School jurisdictions should provide instructional computing inservice mechanisms for their teaching staff, possibly such as those provided by the Edmonton Public School Board. These should be expanded to include classroom networks.*

   - *ATACC should form a special interest group (SIG) to address the topic of networking. The group should operate on a continuing basis with periodic meetings and newsletters.*

V. WIDE-AREA NETWORKING

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B. INTRODUCTION

This working group began the sessions with a discussion of the paper presented by the expert consultant. This was done primarily to familiarize the participants with certain aspects of wide-area networks in use in Alberta schools. After much discussion the term wide-area networking was redefined as **telecommunications**. It was felt wide-area networking was too broad an area to address in the short time available.

The group discussed the issues at hand and defined the major problems in the area of telecommunications. The group defined the following four major problems:

1. Unequal opportunity of access to information (educational, administrative, instructional) for students and educators throughout Alberta.

   a. *Issue:* The present philosophy of education which is present in many of our schools is such that the teacher imparts knowledge, but does not necessarily facilitate learning.

   Solution: Telecommunications through the use of major data bases encourages the teacher to be the facilitator of learning . In today's world it is unreasonable to expect a teacher to have all the knowledge necessary to prepare the students for the world of today and tomorrow. The use of telecommunications can give students the facility to acquire this knowledge.

   b. *Issue:* Access for educators to courses in the field of telecommunications in the instructional setting.

   Solution: There should be more inservice courses for staff in the area of telecommunications. The education of teachers should emphasize courses that deal with all aspects of computers and particularly telecommunications and research skills. There should be a central store of information regarding people who have expertise in the area. This information should be readily available to all school districts in the province.

c. *Issue:* Curriculum design and development .

Solution: Future curriculum development should emphasize thinking skills and research skills on a high cognitive level.

d. *Issue:* Should the librarian be the telecommunications contact person within the school?

Solution: Since the library is the area of knowledge storage and retrieval, the librarian is a logical person to undertake this role in the school setting.

e. *Issue:* There is an unequal distribution of technological expertise and availability of resources in the area of telecommunications.

Solution: Guidelines for the standardization of equipment should be established. Large purchases of software, equipment and the obtaining of licensing agreements for CPU time should be undertaken. Major school districts should be encouraged to share their output and expertise with other school districts in the province.

f. *Issue:* Costs in the area of connect time, long distance charges, teacher retraining, hardware, software.

Solution: Alberta Education should be encouraged to pursue the idea of reduced phone costs from the phone companies. Large purchases of software and hardware would lower costs. This could be accomplished by the standardization and setup of guidelines for equipment and software throughout the province. Districts should establish inservice programs which emphasize skills and benefits in telecommunications.

2. Lack of awareness of telecommunications by educators, administrators, school boards and the public at large.

a. *Issue:* A lack of knowledge of what is now available and how to access the available resources .

Solution: A guide or source book of applications and information regarding telecommunications in provincial schools.

b. *Issue:* Costs for initial setup and continuation of telecommunications program.

Solution: After careful examination of all costs involved, it was determined that any school board in the province could easily meet the costs within its existing budget if long distance phone charges were not applicable.

c. *Issue:* Who needs to be informed?

Solution: Educators, parents, students, board members, administrators, and service clubs.

3. Lack of coordination and communication with regard to telecommunications.

a. *Issue:* Who will take responsibility for telecommunications?

Solution: Ideally each district should have a computer facilitator with some expertise in the area of telecommunications.

b. *Issue:* There is reluctance by some school districts to share information.

Solution: Teachers and districts should be encouraged to use the facilities and expertise of groups such as ATACC.

c. *Issue:* There is reluctance on the part of educators to use existing groups who have expertise in this area.

Solution: Each district should encourage educators to become active participants in these groups.

4. Dissemination of information regarding research and development issues.

a. *Issue:* What projects and issues need to be addressed?

Solution: Each district should have access to Alberta Education 's information regarding research projects.

b. *Issue:* Who should be involved in research and development regarding telecommunications?

Solution: Alberta Teachers' Association Computer Council (ATACC) and Alberta Education.

c. *Issue:* Funding.

Solution: Alberta Education is the main source for funding.

C. RECOMMENDATIONS

- *That the Minister of Education fund and implement a model for telecommunications that will provide equal access to information for all Alberta students and educators . This model should address the following :*
    - *A needs assessment to determine the feasibility of a telecommunications initiative in the classroom.*
    - *An Alberta based electronic messaging and data base facility should be established.*
    - *Cost effectiveness of telecommunications (i.e., special telephone rates, group purchases of CPU time, and membership in information retrieval services).*
    - *Licensing of communications software and CPU time.*
- *That the implementation of recommendation one take into account the formation of a steering committee consisting of representatives from applicable groups such as: Alberta Teachers' Association (ATA), Alberta School Trustees' Association (ASTA), Alberta Education, and Alberta Teachers' Association Computer Council (ATACC).*
    - *That ATACC be the organization to implement the study.*
- *That each school district appoint a computer facilitator. This person should be an active member of ATACC and should act as a leader and an information disseminator in the district.*
- *That school boards initiate a policy which encourages the dissemination of telecommunication information to all groups (i.e., continuing education, home and school, community schools, community colleges and advisory councils).*
- *That Alberta universities require proficiency in telecommunications to be part of teacher education.*
- *That school districts establish inservice programs which emphasize proficiency, as well as knowledge of benefits of telecommunications.*
- *That Alberta Education produce and distribute, both in print and by computer readable format, a list of studies and funded projects relating to telecommunications.*

- *That Alberta Education communicate to all school districts the names of Alberta Education personnel who have the responsibilities related to computers.*

- *That research and development be carried out through model schools and model classrooms with a view to developing optimum use of telecommunications in instruction.*

VI. THE INTEGRATION OF COMPUTERS INTO THE ELEMENTARY CURRICULUM

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B. PROBLEMS

1. How should computers be used in the elementary grades?
2. How should we manage computers for effective instruction?
3. What are the financial considerations for using computers in elementary schools?

C. ISSUES, SOLUTIONS AND RECOMMENDATIONS

1. Uses in the Elementary Grades

   a. Literacy (including keyboarding)

Definition: The minimal skills required to use the intended technology. These would include anything that must be taught but which is not included in the published curriculum or the programs of studies.

Issues: Should it be part of the elementary program ? If so, where and when should it be introduced?

Solutions:

- Literacy is an essential component if we plan to use computers.
- The depth of the literacy program should depend upon the intended use of computers and the skills of the students.

- We should limit literacy to those skills essential to attain the intended outcomes or objectives.

- Research findings should be taken into consideration when planning the literacy program. For example, research on keyboarding has indicated that very young students can attain keyboarding proficiency, that keyboarding expertise can be improved at each successive grade and that upper limits should be set on the skills students are expected to obtain.(Keyboarding should always be viewed as a means to an end and should be taught "properly" or not at all).

Recommendation: ***That literacy be an essential component of the use of any technological application within the school setting. However, the literacy program should be limited to those skills essential to use the intended technology.***

b. Integration of Computers into the Curriculum

- Computer assisted learning
- Problem solving, including the use of productivity tools

Issue: What priority should be given to each of these uses within the elementary program?

Solution: Determine the priority through the following process:

- Select the curricular objectives.

- Identify your students' needs and abilities relative to these objectives.

- Select the most appropriate resources, software and other, to meet the objectives, student needs, and teaching styles. The range of available resources includes human, print, audio/visual, computer, laserdisc and other emerging technologies.

Recommendations

- ***That software which meets identified needs, both curricular and student, be developed by the province.***

- ***That educators consider computers as one of many resources available to meet student and curricular needs. Educators should attempt to eliminate the "mystique of computers".***

i) Analysis of Specific Productivity Packages (Word Processing and LOGO)

Word Processing

Rationale for use

- Word processing is consistent with the current language arts curriculum.
- Word processing encourages students to edit and revise compositions.
- The collaborative approach provides students with immediate feedback on compositions.
- It appears to encourage a more creative approach to composition as students recognize that they can edit the composition at a later date. Students using word processing can concentrate on the free flow of ideas.
- It permits students with psychomotor difficulties to produce compositions more easily.
- Word processing is becoming an integral part of the adult world and students should be developing skills needed in our society.

NOTE: Any benefits derived from word processing will only occur if there is appropriate language arts instruction.

Grade Level

ECS - Grade 2: Simple composition with an easy-to-use software package (e.g., Kidwriter, Write One, Magic Slate). Spelling skills and enlargement of vocabulary can be facilitated through a "games" approach.
NOTE: Word processing has been used in ECS, but greater assistance is required. A collaborative approach is recommended.

Grades 3 and 4: Students should collaborate in their efforts. Longer periods of time should be provided to allow them to edit, replace, cut and paste. Keyboarding skills should be reinforced and expanded to facilitate use of word processing. Appropriate software includes MECC Writer, Bank Street Writer, Magic Slate, Milliken, Touch Type, and Freewriter.

Grades 5 and 6: Use word processor in an independent and more sophisticated manner across several subject areas. However, some students may benefit from a collaborative approach. Use related packages (e.g., spelling checkers). Greater emphasis should be placed on editing, revision and improving communication.

NOTES

- Use of large screen monitors facilitates the writing process.
- The use of word processing should be integrated with the writing process.
  - Prewriting
  - Writing
  - Conferencing
  - Editing
  - Celebrating
- Students should have a choice as to the stage at which they prefer to use the word processor (i.e., some prefer to do the prewriting stage away from the computer).
- Teaching style and classroom management techniques will also affect the stage at which students use the word processor.
- There is a shortage of appropriate software that supports languages other than English.

LOGO

Rationale for use

- LOGO can be integrated with a variety of curricular areas.
- LOGO is an effective resource for achieving curricular goals. Student needs, teaching styles and teacher expertise will likely determine if and how LOGO will be used in the elementary curriculum.
- The steps used with LOGO are consistent with the problem solving steps outlined by Polya and found in the mathematics curriculum.
- LOGO is best used in a child centered, experience based environment. The way it is used should recognize children as capable, independent learners and promote the development of independent problem solving skills.

Grade Level

ECS: "Instant Logo" has been successfully used at this level for producing very simple geometric shapes. Activities which prepare students to use LOGO should be adopted (e.g., knowledge of directions, language development, etc.). Use of regular LOGO appears to confuse children at this level. The use of LOGO may facilitate the achievement of ECS objectives (i.e., encourage language development, knowledge of directions, knowledge of shapes, and encourage creative expression). Computer experiences should be integrated with other activities in the classroom.

Grades 1 and 2: LOGO should be used in an integrated approach. LOGO can also expand and reinforce concepts (e.g., numerical concepts, additional geometric shapes, and language concepts). Modified versions of LOGO will support numerical input. The commercial sources have not produced appropriate software, so local teachers have modified LOGO to match student needs. LOGO is best implemented through a combination of teacher instruction and ample child directed exploration. Teachers require considerable expertise to use LOGO effectively in the classroom.

Grades 3 to 6: At this level, more emphasis should be placed on process skills in science, mathematics, Polya steps, and higher-order thinking skills. Other advanced aspects of LOGO can be used to achieve curricular objectives (e.g., logic and sequencing). Group stories involving animated features can be produced provided that the teacher is able to create support files. There is a need for utility packages and other support materials for teachers.

ii) The following packages or approaches can also be used successfully to achieve curricular objectives at the elementary level.

- Data Base Managers: Example: Computerized access to large databanks and libraries of information, teaching classification, and bibliographies.

- Graphics: Example: The computer can be used in ECS with adult supervision, and throughout Grades 1 to 9 to achieve objectives in art (e.g., Koala Pad and Mouse Paint). Graphs can also be produced to demonstrate concepts in mathematics, social studies and other subjects.

- Music Processors: Teachers can have the children create musical scores or compositions. Students are able to edit and improve compositions (e.g., Songwriter). Computers can also facilitate the teaching of music theory.

Recommendation: ***That the province identify specific CAL (Computer Assisted Learning) and productivity packages that facilitate achievement of curricular objectives in all subjects throughout the elementary school program. Classroom teachers should be involved in the review process.***

c. Future and Recreational Uses

Students need to be aware of the extent and implications of the permeation of technology throughout our society, including the limitations of the technology and the role of people in the use of technology.

RECOMMENDATIONS

- ***That educators encourage the use of computers and related technologies by providing more access for students beyond regular instructional time (example: computer clubs, and loan of software).***

- ***That the knowledge, skills, and attitudes relative to the use of technology be incorporated into the programs of studies and be articulated with comparable knowledge, skills and attitudes at the secondary level to ensure consistency and growth in student experiences.***

d. Elementary School Resources

RECOMMENDATIONS

- ***That Alberta Education develop comprehensive units that facilitate the use of computers to achieve curricular objectives. These units may include a variety of resources including software. For example, use of LOGO, word processing, other creative applications, and data bases.***

- ***That Alberta Education develop a human resources bank of experts who can assist other educators to integrate computers within the elementary school curriculum.***

2. Classroom Management

a. Physical Arrangement of Hardware

Ideal - To achieve complete integration of computer related activities with curricular objectives, computers should be available in all of the following modes: stationary classroom units, mobile units, and lab configurations.

Recommendation: ***That decisions relative to classroom management should be made after objectives and the intended uses of computers have been analyzed.***

b. Teaching Strategies

Teachers should apply knowledge and skills currently being used in the teaching process to facilitate integration of computer related activities. For example, effective organization of small groups, timetabling access to hardware and software, individualizing instruction, lesson design, and preplanning (especially during a first visit to the lab facility) .

A mentor system that encourages teachers within a school to support each other and to share ideas and information would be beneficial.

Recommendation: ***That long term research be conducted to analyze the impact, if any, of the use of computers on teaching and learning styles.***

c. Management of Software

Recommendations:

- ***That computer software be integrated with the library collection.***
- ***That school districts develop centralized collections of software both for preview and for student and teacher use.***

3. Financial Considerations

a. Hardware

Recommendations:

- ***That elementary schools be equipped both with computer labs and classroom computer centres to facilitate the integration of computers into the elementary program.***

- *That the computer lab be removed from the utilization factor used to determine space to be funded within a particular school. Both new and existing schools should have provisions for computer facilities with ergonomic furniture and sufficient electrical service.*
- *That annual provincial funding and local budgeting allow for the purchase of new hardware and the replacement of existing hardware.*

b. Software

Recommendation: *That annual provincial funding and local budgeting allow for the purchase of new and replacement of existing software.*

c. Personnel

Recommendations:

- *That school jurisdictions provide technical support to service computers and related technologies.*
- *That district curriculum consultants and supervisors provide teachers with assistance to facilitate the integration of computers within the curriculum.*

d. Planning

Recommendations:

- *That annual provincial and local budgeting allow for purchase and replacement of software.*
- *That the province develop comprehensive policy, guidelines and procedures to facilitate the integration of computers into the curriculum.*
- *That based upon the provincial policy, schools and school jurisdictions need to develop long and short range plans to facilitate the integration of computers into the elementary curriculum.*

OVERALL RECOMMENDATION

That the Strategic Planning Symposium reconvene every two years to:

1) Assess the progress made towards the achievement of the recommendations presented at this Symposium.
2) Assure that educators continue to be engaged in strategic planning to facilitate the attainment of educational objectives.

VII. THE INTEGRATION OF COMPUTERS INTO THE SECONDARY CURRICULUM

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B. INITIAL MAJOR CONCERNS

- Where do we go after computer literacy? Can computers be effectively used in other areas such as mathematics and science?
- Using computers in other areas besides mathematics.
- Encourage mathematics teachers to make better use of computers. How can the upper administration aid in the effective instructional use of computers?
- Frustrated high school students need motivation. How can we adapt to changes in society? Students need a purpose.
- How will computers be integrated with classroom instruction in light of major school renovations? Using computers in the classroom, administration, access to computers by a variety of classes.
- A great deal of money has already been spent. How can we be cost effective? Plans need to evolve. What is it we are trying to achieve? Where should the available funds be spent: software, hardware, or teacher training?
- Computers should be used more in science. We need better access to information on software.
- What do we do to initiate and maintain teacher interest in computers?
- How can the teachers use the computer as an instructional tool? How can we improve our teaching with computers?
- How do we best address the problem of articulation between programs in elementary and secondary schools?
- How do we alter the curriculum to incorporate appropriate uses of computers?

- A major problem exists in designing curriculum so that it adequately reflects the capabilities and limitations of computers as aids to problem solving and examines the computer as a source of problems.
- It is difficult to get staff to use existing facilities and software. There is a need for extra funds for software.
- How do we expose teachers to high quality software and how do we get them to use it?

C. STATEMENT OF THE PROBLEM

We recognize that each discipline has its own goals. The computer is a powerful aid to solving problems within each discipline. However, the computer generates problems of its own within each discipline. A combination of subject matter specialists and computer knowledgeable educators should decide how the computer should be appropriately used.

D. INITIAL STATEMENT OF THE ISSUES TO BE ADDRESSED

1. Articulation Between Levels

We must come up with some kind of statement about the skills and abilities we expect students to have when they reach junior high school. We want elementary school students to be able to keyboard, use application packages, do process writing in a word processing environment, etc. Secondary schools will take over from there.

2. Computer Costs Per Student

It may be feasible to provide each student with a portable computer if the cost is amortized over the life of the computer. For example Calgary is experimenting with Tandy 100 computers. Each contains 32K of RAM and costs $400.

3. Experience Gained in Introducing Calculators

What should students know about calculators by the time they reach junior high? Calculators are now accepted by the high school mathematics curriculum. Can we see the same thing occurring with computers?

4. Changes in Curriculum

Is it appropriate to substitute calculator and computer skills for currently taught basic skills?

5. Programming

   How much do we want people to know about computer science?

6. CAI

   When CAI is cost effective and educationally sound, should it be used?

7. Teacher Friendliness

   Computers must be easy enough to use so that teachers see the computer as something which aids rather than hinders their efforts. For example, all teachers should be provided with computers for home use.

8. Curriculum Scope and Sequence

   We need a scope and sequence for integration of the computer as a tool. We need appropriate hardware and software to support the scope and sequence.

9. Cost Effectiveness

   What is the most cost effective balance among hardware, software, teacher training and curriculum materials to implement the scope and sequence?

10. Time for Teachers

    We need good support for teachers over the years as we implement the scope and sequence. Transfer of students will continue to be a problem.

11. Parent Support

    This is essential if any program is to be successful.

12. Testing

    Current testing practices may inhibit or prohibit the integration of the computer as a tool.

E. PRIORIZED ISSUES AND SOLUTIONS

1. Support for Teachers from Outside the Classroom

   - The ratio of qualified computer consultants to teachers should be approximately 1:100 or equivalent (on a time frame, project basis, not necessarily full-time).
   - Inservice (release time for teachers dealing with computers, sabbaticals with preference for computer education), involvement of curricular area specialists already in place.

- Equipment should be made available to teachers, including software (i.e., tag on school purchase cost or loan computers to teachers on a semi-permanent basis).

- Institutional networking (electronically, may also involve inservice, joint ventures on the production of materials, conferences, network BBS for subject areas); involve curriculum specialists.

- Guidelines set by Alberta Education (level of support available to teachers).

2. Software and Hardware

   - Alberta Education's software Clearinghouse should be given more resources to accelerate its evaluation cycle and broaden its scope in examining existing software.

   - Conduct a feasibility study regarding the possibility of Alberta Education creating production teams to write software or modify existing software. This could be done by Alberta Education or contracted out to the private sector.

   - A provincial body is required to negotiate licenses, analyse hardware and software trends, look after a central repository of software, develop a province-wide plan for software, and negotiate province-wide purchasing of contracts without being specific about the type of computer.

   - Expand or extend BQRP to provide a more equitable distribution of funds between the junior and senior high schools.

   - Preview system mailout or a travelling consultant with a collection of software.

3. Curriculum

   - Define goals for each subject.

   - Rewrite course objectives in light of the potential use of computers.

   - All things being equal, preference should be given to materials that integrate computers.

   - Provincial examinations should reflect the use of computers.

   - Media resource materials and computer software should be matched with the course objectives.

   - Unless strictly prohibited, access to computers should be provided to students writing examinations (some investigation should be made in this direction).

- Each discipline should require students to learn about some of the appropriate uses of computers for that area.

4. Computer Skills and Articulation

   - A clear statement of computer skills to be possessed by students by the end of grade 6, grade 9, and grade 12 is required (e.g., keyboarding as fast as they can write, word processing, graphics packages, data base, and telecommunications).

5. CAI and CMI

   - Increase productivity of students and teachers by appropriate and cost effective use of computers.
   - Embedded CAI can produce instruction within a functional device.
   - Education must be emphasized rather than training.
   - Enhance the breadth of opportunities to students (especially in small schools).

6. Resources and Management in Schools

   - All departments should have access to funding, based on need, to acquire and maintain appropriate computer facilities.
   - Schools need to give thought to equity.
   - The Calgary Board of Education is experimenting with the provision of Tandy 100 computers, which the students can take home.
   - School systems must provide equitable access to computers for all students.
   - Each school should have a plan for managing computer resources.
   - Resources should be available within the classroom to support the teacher in the use of computers (e.g., large monitors or display devices, video tape or disc, furniture, and cabling).
   - Special peripheral devices are required to support special requirements (e.g., science lab and for the handicapped).
   - May need to add personnel to manage these resources (technician).
   - Provision for maintenance should be available to all systems.

7. Teacher Preparation

   - Persons trained in certain subject matter areas should have solid knowledge of how the computer may be used to solve problems in their particular subject (the potential capabilities and limitations).

8. Computer Science and Programming

   - Below the high school level, programming should be taught not as an end in itself but as a problem solving tool.
   - Select applications which fit into various curriculum areas.
   - Computer science courses should be available to all high school students.

F. RECOMMENDATIONS

- ***That there should be a substantial increase in support to teachers through access to consultants, inservice training, computer facilities loans, and greater access to information.***
- ***That provincial support for hardware and software acquisition, and in planning, be increased across the entire curriculum.***
- ***That as Alberta Education's secondary education review proceeds, careful consideration be given to the role of computers in each discipline. We further recommend that consideration be given to allowing the use of calculators and computers in all diploma and achievement examinations.***
- ***That Alberta Education provide a clear statement of computer skills that are to be possessed by students at the end of grades six, nine, and 12.***
- ***That computer assisted instruction be used when it is more economically and educationally sound than traditional alternatives.***
- ***That all departments within a school should have access, based on need, to funding for appropriate computer resources. We recommend that each school provide support for teachers in order to make it easier to use computers in their classrooms.***
- ***That teachers should have solid knowledge of how the computer may be used to solve problems in their particular area of expertise.***
- ***That computer science should be available (as an option) at the high school level. We recommend that computer programming be taught at the junior high level in support of other curriculum goals, but not as an end in itself.***

VIII. ADMINISTRATIVE USES OF COMPUTERS

A. PARTICIPANTS

Borman, Lyle
Caron, Ken
Easton, Eunice *Group Leader*
Frattini, Doug
Gough, John
Hatridge, Lorna
Kroetsch, Marvin
MacDonald, Robert
Montgomery, Paul
Newman, Barbara
Patterson, Jack
Riewe, Valerie
Robinson, Karen *Dept. Rep.*
Rook, Dean
Schienbein, Ralph *Expert Consultant*
Sohnle, Ron
Van Tamelen, Dave
Welsch, Richard

B. ISSUES

- How will we cope with the diversity that exists in the province?

- What common linkages need to exist between central office and school offices?

- How do we determine the needs for a particular district :
  - Keeping in mind the students?
  - Determining needs vs. wants or vested interests?
  - What is the most effective and efficient system?

- Which information needs to be :
  - centralized?
  - decentralized?
  - distributed?

- What kind of standards need to be set :
  - for a school district?
  - for the province?

- How do we get consensus and support for standards?

- How long do standards apply?

- How do we make sure that standards don't impede progress?

- How much diversity do we allow?

- To what degree can/should hardware and software be mixed and matched?

- Who will evaluate and share information on administrative uses of computers in schools, central offices and government departments?

- How can small school districts obtain information and consultative services?

- What kind of tool could be devised to evaluate and help administrators decide:
  - When to update hardware?
  - When to update software?
  - What power is required for a particular task?

- How do we plan for constant change? At what point does one "jump in"?

- How much is enough?

- Training senior administrators :
  - Time management?
  - What is done with time that has been freed?

- Computer systems support :
  - What technical support is required to maintain computer systems?
  - How do small districts away from the large centres get support?
  - Should we train our own service people?
  - How can inservice be provided for clerical personnel?

- How do we increase :
  - Buying power ?
  - Provincially negotiated licenses?
  - Bulk buying?
  - Site licenses?

- Are we going to make electronic systems mandatory?

C. PROBLEM IDENTIFICATION

1. Where are we at?

   - Many school jurisdictions in Alberta have implemented computer technology in central office and school offices for financial services and student information management. There is a great diversity in the types of equipment and the programs which have been used. Although Alberta Education has taken some preliminary steps toward automated systems, the information flow between it and school jurisdictions is still largely paper driven.

   - There is a desire on the part of all school jurisdictions to make decisions regarding the automation of administrative services which are not only efficient, but also in the best interests of the students served. Small jurisdictions, particularly, are concerned about sharing the collective wisdom of those who have already had experience in the field.

2. Where do we want to be?

- The picture of where school districts wish to be in the next few years was viewed from six perspectives. These included the creation of a master plan for the province, the provision of human resources to support administrative computer systems, the development of instruments to assist in the assessment of the needs of a particular district, the provision of efficient data communication systems, the integration of computer managed learning systems into the administrative applications, and the necessity of providing additional funding for computer implementation into the administrative environment.

D. THE MASTER PLAN FOR COMPUTERS IN ADMINISTRATION

1. **Recommendation:** ***That as a result of this Symposium, a Task Force be established which would develop a master plan for the integration of computers into various levels of school district administration.***

2. It is recognized that the following are obstacles to this recommendation

    - There exists in Alberta a great diversity in both the needs and the present implementations.
    - There will likely never be complete agreement on implementation specifics, but there should be agreement on major goals.
    - There has been a lack of leadership from Alberta Education in the past.
    - There is a problem with lack of data standardization in the present system. For example, school districts and the province use different codes and different specificity for recording P.A.B. codes. The vocabulary for special education categories changes from one district to another; course codes are different, etc.
    - Adequate resources, both personnel and financial, will always be a problem for districts.
    - Standards which are too restrictive stifle creativity and innovation.
    - There are some things which need to be standardized, such as data interchange, and other things for which more general standards should exist to give districts more latitude in choosing the systems which best suit their needs.
    - Alberta Education does not wish to recommend specific brand name products, except where there is a choice among several.
    - There are political pressures to recommend Alberta products.
    - There must be a recognition that a master plan will not automatically ensure implementation.

- There can be a mystique regarding data ownership which mitigates against designing systems that are the most efficient.

3. **Recommendation:** ***That a task force with the following responsibilities be created*** :

    - To represent all stakeholders both within Alberta Education and within the school jurisdictions.
    - To cooperate with interest groups such as the Conference of Alberta School Superintendents, the Association of School Business Officials of Alberta, the Alberta School Trustees' Association, the Alberta Teachers' Association Council of School Administrators, and the Faculties of Educational Administration at the universities, to develop consensus on issues and problems such as coding.
    - To investigate what the research says and to examine what is happening in other provinces and in the United States.
    - To develop a plan which will integrate both financial and student information concerns.
    - To develop a plan which emphasizes DATA and not hardware or software.
    - The access to information and the ethical use of data must be a caveat on the plan.
    - It is recognized that plans must be fluid and must include contingencies for adapting to rapidly changing needs and technologies.

4. **Alternative recommendation:** ***That a consortium of school districts be formed to elect a steering committee and hire a consultant to formulate a game plan. Funding would be sought from Alberta Education's Planning and Research Branch.***

    This alternative is not considered to be as desirable as direct involvement by Alberta Education in all phases of the development of a master plan.

E. PROVISION OF SUPPORT FOR AUTOMATED SYSTEMS

1. RECOMMENDATION: ***That Alberta Education form a branch or a unit which would provide information management consultants to assist jurisdictions in a concentrated effort to provide equity among all boards.***

   - Because of the interdisciplinary nature of administrative computing systems, this branch or unit should report directly to the Deputy Minister of Education.

   - Districts could be charged back on a cost basis for this service.

   - There is need for coordination of information about what districts are doing regarding automated systems and what problems are being encountered so that we are not constantly re-inventing the wheel.

   - The government does provide consultants in curriculum, for libraries, for agriculture, etc. Data management consultants are desperately needed, especially by small jurisdictions, but also by large urban boards which are now serving as consultants to the province.

   - Hardware is the least costly item in the implementation process; needs assessment, training, and software modification and upgrades are also of great concern.

   - Job descriptions and hiring practices need to change to reflect the requirement for computer expertise.

   - Guidelines for technical support questions and implementation problems with regard to technical support need to be addressed on a continual basis after the initial purchase.

2. RECOMMENDATION: ***That Alberta Education provide assistance for inservice of administrative and clerical personnel.***

   - Present inservice grants are meant for teacher inservice and cannot be used for administrative or clerical training.

   - Principals and secretaries are working with quill and parchment while students are working confidently with high technology.

   - Special grants may need to be given to small rural districts to allow them to "catch up" with technological advances.

   - Inservice opportunities need to be regionalized to cut down on the associated costs of such services.

F. ASSESSMENT OF INFORMATION NEEDS

RECOMMENDATION: ***That school districts develop needs assessment instruments to assist in the decision-making process.***

- Districts should define administrative needs by first examining information which is important to a school system.
- Definition of the types of data is the next step.
- Criteria developed by the Edmonton Public School Board and Alberta Education, Planning and Research Branch, for evaluating Student Management Systems.
- Use an established methodology (e.g., Kepner Tregoe Decision Analysis Technique).
- Look at ways of manipulating the data to get the desired reports
- Choose software which is versatile - such as a relational data base
- Last of all, choose the hardware

G. DATA TRANSMISSION

RECOMMENDATION: ***That Alberta Education negotiate reduced rates from Alberta Government Telephones for school districts to communicate within their own boundaries and with Alberta Education.***

- RITE telephone lines provide the capability to furnish telecommunications. Rate structures are important, but so are subsidies or a combination of user-pay and subsidy.
- The Alberta Education bulletin board should be available free of charge to all school districts.
- Alternate methods of transferring data between school districts and Alberta Education need to be found and standardized.

RECOMMENDATION: ***That if services such as electronic bulletin boards are provided to school districts, they must also be accompanied by training programs.***

- Don't offer a service for which standards have not been set and people have not been trained.
- If future initiatives are deemed sufficiently important to be province-wide, then support must be provided.

H. TEACHER SUPPORT FOR COMPUTER MANAGED LEARNING

RECOMMENDATION: ***That Alberta Education, in cooperation with school districts, evaluate the available commercial computer managed learning systems.***

- Computer managed learning systems are a logical extension to the directions that the province has in terms of individualized education plans for students. (IEP's)
- There are some commercially prepared programs that need to be evaluated before we embark upon development of our own data banks.
- Provincial data banks for curriculum objectives, learning activities, and test bank items should be developed.
- Computer systems are able to handle these large amounts of data but individual districts should not each be developing these banks. Access could be provided via telecommunications.
- Although we have not yet reached the place where IEP's are required, long range plans need to include the possibility of computer managed learning.

I. FUNDS FOR HARDWARE ACQUISITION

RECOMMENDATION: ***That funding mechanisms be established to make it possible for school districts to implement or upgrade computer applications in administrative areas.***

- At this time, BQRP funding is not intended for this purpose.

IX. THE USE OF COMPUTERS IN BUSINESS EDUCATION

A. PARTICIPANT

Cobb, Ken
Crane, David
Friesen, Cliff
Haines, Dorothy *Group Leader*
Iannone, Tom
Klaffke, Ernie
Loewen, Carol
MacKay, Keith
Morrow, Robert
Prather, Sharon *Expert Consultant / Dept. Rep.*
Rennie, Jim
Simpkins, John
Sloane, Blair

B. ISSUE STATEMENTS

1. There were concerns identified with respect to the teacher involvement in implementing computers in the business education program. The issues noted were:

   a. The time demands on teachers to learn to use software, hardware and to implement the new curriculum with its new resources. In some cases, this means that teachers are unable to prepare adequately to meet individual needs. This is particularly difficult for teachers without preparation in business education courses or programming and software skills;

   b. Some "computer" teachers are deemed to be experts. This places additional pressure on them to manage the computer lab, inservice colleagues, be the staff advisor to computer clubs and evaluate hardware and software. As these expectations are raised by themselves, school administration, other teachers, students and the community, it is difficult to say no;

   c. The need for teachers to be provided with the opportunity to partake of professional development activities which give them confidence to fully implement computers and to use the related methodology. This opportunity would encourage those teachers who are reluctant to integrate computers.

RECOMMENDATIONS

- ***That teacher professional strategies be implemented to include:***
  - ***A province-wide telecommunication system for the purpose of sharing ideas, projects and resources;***
  - ***Identification of key personnel (teachers, business community members, specialists) who can provide inservice assistance as required;***
  - ***Support for teachers to purchase computer hardware.***
- ***That these inservice strategies should allow teachers the opportunity to define professional development needs, attend professional development activities, and implement the acquired skills.***

2. There were concerns identified with respect to program implementation strategies. However, the flexible nature of the program was perceived as useful in helping to meet the diverse needs within the province and individual jurisdictions. The issues noted were:

   a. Whether the program reflects the needs of the business community and how the business community could become more actively involved in the program

   b. The future of programming

   c. The pace of the program implementation, the need to acquire hardware and software and the need to upgrade facilities has placed severe limitations on the jurisdiction's time for decision-making

   d. How the computer integration will be maintained after BQRP funding is over

   e. That there may be a lack of coordination within some school jurisdictions with respect to equipment purchases

   f. That there may be a need to establish minimum standards for student achievement within the business education program.

RECOMMENDATIONS

- ***That the business community participate in curriculum development, in setting standards, and in providing resource personnel.***

- ***That post-secondary institutions provide courses (on-campus, teleconferencing, satellite T.V.) that reflect the business education curriculum (programming in Pascal, telecommunications, etc.) and university requirements at times when teachers can access them.***

- ***That course planning (Computer Processing 10, 20 and 30) utilize the flexibility of the module system to accommodate the various levels of student interest and skills in programming.***

- ***That minimum standards for student achievement be established within the curriculum documents.***

- ***That keyboarding skills be taught at the elementary school level and that elementary teachers be provided with necessary inservice.***

- ***That the BQRP equipment upgrading grant deadline be extended to coincide with the BQRP modernization grant (1988) to allow more effective and efficient implementation.***

- ***That support for an "evergreen" hardware and software policy be provided through provincial grants.***

3. There were concerns identified with respect to resources . These included hardware, software, facilities and print materials. The issues noted were:

   a. The high cost of software required for the business education program

   b. The lack of clarity with respect to copyright laws

   c. The range of choice in hardware and software markets and the lack of direction available to school jurisdictions

   d. The lack of instructional materials to support the particular software that is being integrated. It was noted that many teachers have developed good support materials

   e. The potential value (and problems) of using networks and bulletin boards as a means of communication, not only in the classrooms, but among teachers

   f. The computer labs are in demand by areas other than business education

   g. The ratio of computers to printers

RECOMMENDATIONS

- ***That software be identified as a basic resource and that the province use its buying power to negotiate substantial discounts.***

- ***That each jurisdiction be provided, as soon as possible, with an easy to understand statement on Canadian copyright laws, particularly with respect to software use in schools.***

Appendices

KEYNOTE PRESENTATION

to the

STRATEGIC PLANNING SYMPOSIUM

for

COMPUTERS IN SCHOOLS

by

THE HONOURABLE MR. DAVID KING

January 29, 1986

Ladies and gentlemen, I am pleased to be here. You don't know what is going to happen in the next 25 minutes - and the fact of the matter is, I don't either, because there are so many things that I would like to say to you. I would also like us to have the opportunity to chat about some of these things, even if very briefly.

I am speaking to you this afternoon with some sense of frustration, but on the other hand, if you know anything about me, you know that frustration is what galvanizes me. I hope that I can persuade you that we should all be frustrated about our lot, and we should all be galvanized into constructive action because of that.

How many of you carry business cards? How many of you have printed on your business card information about how someone could reach you by computer and modem? A line of information about protocols? Good. One. Two people. I'd really like to see those cards afterwards. That is something that I want you to remember during the course of my remarks this afternoon.

Just over four years ago, I gave a speech to the Alberta Society for Computers in Education. A lot has happened since then. Computers have been introduced into our schools in relatively large numbers. Yet, the demand for more computers continues to outstrip the supply in our schools. The more computers we put in, the more people want to see. Technology has developed, and unit costs have dropped dramatically. But the cost of packages, the cost of software, the cost of overhead are increasing just as dramatically. Awareness of the potential of the computer has increased dramatically, yet, at the same time, so has something else that I would call "embarrassed ignorance".

Four or five years ago, if you didn't know about computers, it was all right at a cocktail party to say, I don't know about computers, and then to go on to ask the most basic, the most elementary question so that you could educate yourself. We have reached the point today, where a lot of people who know very little about computers are afraid to admit their ignorance, and so they are afraid to ask the elementary questions that would lead them to an education. The computer encourages what economists might call "perfect competition". In the social sciences, one would use a different phrase for it, but the idea is that each of us may be more nearly equal in terms of the resources that are available to us, especially if we count information and the ability to analyze information as the most important resource that will be available to us in years to come. On the one hand, while the computer is encouraging this more nearly perfect competition, or more nearly equal opportunity in respect to information, the industry itself looks to be plummeting into monopoly. In every aspect of discussion about computers, we can recognize diverging or even conflicting trends. We shouldn't be surprised by that. It's the same with every technological development. It can be used for good or for ill. How it is used depends on the individual humans and the human communities, and the decisions that they make. But it will be the human community that will worry about the divergence of these trends, or the conflicts, the conflicting implications of these trends. The computer itself disregards all of this and blithely, or brutally - depending on one's point of view -- proceeds to become ubiquitious in the community.

Imagine that you are on a little rise out on the prairies a hundred years ago. You're on a little plateau and a stagecoach is on the trail in front of you, about a mile and a half down the road. It's approaching a fork in the trail. Your brother is in the driver's seat. Your family is in the stagecoach. You would like to catch up with it. You would like to meet them and greet them, but they're going to be past the fork before you can do that, even on your pony. You've got to make a decision about which pony trail to take, headed for which road on the other side of the fork, as you try to meet your family in the stagecoach.

Maybe that's not a good illustration of our current dilemma. Suppose we've never been over this ground before. When we come to the fork in the trail, which path are we going to choose, and how do we choose? If we make a mistake in our choice, can we recognize the mistake in time to make mid-course corrections? Now we are more like explorers or scouts. We want to survive the experience of this exploration. We want to make the unknown territory known, and then we want to make it our own, for ourselves and for all members of our family and our community who are coming along behind us. We would like to survive the experience, not only for our own self interest, but also for the good of the community.

Today, in respect of computer education or computers in society, this represents an acknowledgment by all of us that the scouts need to hunker down and council together for a little while, before they make a collective decision about how they are going to proceed. But we can't stay hunkered down for very long. Eventually we have to get up, and make decisions, and get on with the job. We can't wait for the wagon train to overtake us. So let's look at this environment. Let's look at the landscape. In a land that is new to us, we have to try to decide what is significant and what is not significant. If I were dropped into the middle of the Amazon jungle, I wouldn't last twelve hours because not recognizing what is significant in that environment, I wouldn't pay any attention to the branch cracking behind my back. Not until the puma was on me! The same is probably true of an Amazonian Indian, who could be dropped on the corner of 1st Street and Jasper, and would attach no significance whatsoever to that little light over there that changes color occasionally, and would step out into the middle of oncoming traffic. We are in territory that we don't understand. We've never been over it before. We look around; there's all kinds of things that we can see. We do not know how to attach what kind of importance to what we are seeing and observing, and it makes our task very difficult. I can't be much help to you - not in answering the questions. The only thing that I can do, for a few minutes this afternoon, is chat about some of the questions that we might ask ourselves. I'd like to talk about five that loom very large in my mind. These are difficulties that we are going to face in the next three to five years, in trying to make progress toward successful, effective integration of computer power into the educational process.

One thing that concerns me is that there has been, and there continues to be, resistance to computers. Sometimes the resistance has been very, very passive, but effective nonetheless. Sometimes the resistance has been very active. Sometimes, in fact, people have denied that they are resisting, yet their actions belie their words. We cannot introduce computers. We don't have the teachers. We don't have the computers. We don't have the software. We don't have the system. We can't do this and we can't do that. There has been a lot of resistance: passive resistance, active resistance, denied resistance. And recently, resistance has been joined by this "embarrassed ignorance" that I referred to earlier, which is going to be as big an obstacle to the success of our task as is resistance itself. This is going to be a drag on what we are trying to do, as we carry along with us people who don't understand what the opportunities are, do not understand what the challenges are, and yet in both cases will pretend that they do. Both resistance and ignorance have been fostered somewhat by unthinking zealots of computerization. We ourselves, and others like us, are the people who have sometimes made others embarrassed to ask questions about computers. We are the ones who have oversold computers.

You know I'm a layman, not an educator, and I don't have a computer background. I'm a classic case study. In the office of the Minister of Education, where I'm responsible for a budget of $1.4 billion dollars a year, with 800 people in the department, I am still trying to get a few things done that popular computing told me six years ago were technologically possible - the software was on the shelf, just go and do it. I am still trying to get some of those things done. Milt Petruk has promised that he will help.

The computer has been oversold in terms of what it is immediately possible to do with the computer. Everybody's walked into the store and been told, "no the software isn't here this week, but we're going to have it next week." Everybody reads the magazines that have done tests on data systems on the promise of the manufacturer that the production model is going to be available next week, and nine months later, are still wondering where it is. B.C., in the cartoons, oversold the wheel. The point is, with respect to resistance, that even if that tool cannot do what we want it to do today, it is capable of it. There should not be any mistake about that. It is capable of doing just about anything that we can imagine, and so we shouldn't reject it on the basis of its limitations of the moment. We should accept it and say, we are going to be part of finding out how to make it do tomorrow something that it is not doing today. There is no point in resisting the computer. There is no advantage in that. The computer is an incredibly powerful tool if, from one end of the community to the other, we will make ourselves part of enhancing its power.

The second thing that concerns me is that there has been far too much attention to hardware. I said, four years ago, that we were too concerned about hardware, and it continues to be the case. Not only is the hardware less important than the software, but because it is so visible, fear of making a mistake about hardware causes paralysis in the decision-making process. Because if we're afraid about making a mistake with respect to something that is very visible, we tend to be status quo oriented, and rigor mortice sets in. There is a man in a three-piece grey flannel suit who stalks the land saying that no one was ever fired for buying IBM. That's probably true. No one ever got a promotion for buying IBM either on the basis of that decision having been innovative, imaginative or cost effective. We have got to attend more to software applications. We've got to worry less about the hardware.

Remember the terrible mistake that I made three years ago, buying one thousand Black Apples. Do you remember what a damning criticism that was of me? The fact is, it washed off my back like water off a duck's back, and today we've got 23,000 microcomputers in Alberta schools. One can make a lot of mistakes on the way to a desirable objective, but if they were made within general parameters of reasonableness and careful thought, the truth is they are not mistakes in the mind of anybody, except a few severe critics.

Referring back to my first concern. There are too many people who treat the computer as if it could or should replace the human mind or spirit. We cannot afford to mystify the computer. We must constantly and consciously strive against the mystification of the computer, even if it looks as if mystification would be in our own short-term best interests. The worst thing that happened to education was the developed conviction in the late 50's and 60's that education as a social institution could solve all the problems of the world. Give the war on poverty enough money, and it might take us two generations -- but education would solve the problems of racism, life in the ghettos, economic exploitation, and the list went on.

Neither institutions nor machines will solve human problems. Only humans using their institutions or their machines are capable of solving those. But when we leave the impression that our institutions or our machines can solve human problems -- when we create great expectations for them -- we also create the basis for great disappointment and suffer the backlash, which is what happened in education in the early seventies, when people said we poured all this money into education. We still have a war in Vietnam said the Americans. We still have poverty in our inner cities. We still have racism. We are very, very disappointed in our educational system. I don't want the overselling of the computer or the mystification of the computer to lead us astray, to lead us to a backlash and to lead us to misuse of the computer.

The fourth thing that concerns me is that, in all of this, there is a tendency to think of government policies and programs as etched in stone and long term. There is an even worse tendency among the general population to believe that governments think of their policies and programs as long term. Nothing could be further from the truth. We've got to remain flexible in this area, and certainly in every other area. We are not making decisions for ten or fifteen years down the road, except perhaps insofar as those decisions affect outlooks, attitudes and perspectives. Four years ago when we said we were going to introduce computer literacy programs, I remember saying that I thought computer literacy courses were going to be a short term phenomenon, and I think they are going to be. I don't think that we should give computer literacy courses a very high priority in the years to come. Certainly, for a while longer, they are going to be part of what we are doing, but we make decisions, plan programs, develop policies that are appropriate to the circumstances, and we should be prepared to abandon them as circumstances change, without regret, and without this mood that says, we were the originators of it so we've got to be the ones who hang on to it.

Fifth, there is a tendency to ignore some of the very deepest currents that are at work here. We talk about hardware. It's less important than software. Software is less important than some other considerations. The computer will likely have a profound effect on how we organize the learning experience. Yet, so far, I see people tinkering with the modification of the existing system, rather than thinking about what kind of a dramatically new system they would like to have at some time in the future, and how we can move ourselves over time incrementally from one model to the other.

I think there are going to be changes in the school, in the classroom, in the library, in the relationship of the teacher to the student, in the relationship of the home to the school, in the relationship of the school to the workplace. I see all that we have understood about these things breaking down. I see quite a widespread recognition that these things are breaking down. I don't see enough deliberate thinking about how to reform them out of this breaking down so that we shift direction to a model that we are able to articulate and describe to others in the community.

I think that the computer will likely have a profound effect on our understanding of the vital role of teachers. A lot of you have heard me say before, that I think teachers have this model in mind, that they are like an organic data base that stands in front of the classroom, and must be able to answer every question that a child asks, or else you criticize it for malfunctioning or having limited RAM, or limited off-line storage. It is not the responsibility of a teacher to be able to answer every question that a child asks. And it is not the responsibility of teachers to do the work for children, not in grade ten, and not in grade one. Maybe if we could come to grips with that, we would have a better understanding of what it is that is meant to happen in the classroom. I think teachers are meant to be the leaders of an exciting enterprise.

They are meant to be team leaders. Instead of pouring learning into the head of a child, they are meant to help the child understand how through life they can acquire that learning for themselves.

One of the questions about the computer is, is it going to provide children with a much better data base than the organic data base standing at the head of the class? And on that, I will bet on the computer. If teachers want to continue to model themselves as an organic data base in a contest with computers, they will lose. They should lose, because that is a much less important role for teachers than another role I can imagine that is vital and which will never end, no matter what we do with technology. Having said those two things - the computer is going to change how we organize learning; the computer is going to change our understanding of the role of the teacher - but the computer is not going to change the essential nature of education. Our purpose is still to teach children how to think; to teach them how to think critically; to teach them how to attend to their environment; teach them how to be excited by the opportunities in their environment; teach them how they can and should make a contribution to the constructive unfolding of that environment. Education is always going to be a liberal arts endeavor no matter how much technology we provide to complement the activity of education, and we should never forget that.

There is a lot that has been done, and I am really pleased with the accomplishments of educators in Alberta. I take very little credit for what has happened, because the good things that have happened have happened most often and essentially in classrooms, and at the school district level. We have provided money; we've provided some skilled people; we've provided some leads; all of that is support to what's happening at the classroom level, and I am pleased by the accomplishments of the last five or six years. But the fact remains that a lot needs yet to be done. The decisions were easier four years ago, because the horizon was so much less burdened; the horizon was so much clearer. Now we are coming to the time when decisions are not so easy to make, and they have to be made on the basis of knowledge, commitment and your outlook. There can't be any more decisions that come from the top down. The significant decisions that come in the future will come from the grass roots up.

You know that I am also a big fan of community education, and it strikes me that our challenge is somewhat like the challenge we faced in community education. We went through stage one, which was the community use of schools. We moved to stage two, which was community schools. We are moving into stage three, which is community education. We've moved from computers in schools. We are moving into computer assisted instruction and computer managed learning. It's a stage we can't avoid. We've got to go through it. But I think we want to go through it as quickly and effectively as we can so that we can get to a stage beyond that, which I might call the computer assisted environment, educational environment or social environment.

The philosophers say that we are dealing with the phenomenology of change. We are guerillas. On this issue, I am proud to count myself a guerilla as much as you are. We've got to unite together, no matter what our office, no matter what our area of responsibility. We've got to take advantage of some of the powerful networking opportunities that this particular technology calls up. We've got to join ourselves together to accomplish what we are all hoping for. If we do that, it will happen. And if we are able to do it in Alberta, a little bit in advance of others, we will learn lessons that can be picked up anywhere else - greatly appreciated - and lessons that will change the nature of education and change the nature of the community.

Thank you very much.

QUESTIONS

Q. What kind of rumor would you like to start about software support for the next couple of years?

A. I think you know that in the department we are very concerned that most of what is called educational software is not educationally sound, and a lot of it is frustrating to deal with. So far, we have concentrated on evaluating the existing software through the Clearinghouse. In my view, it is past time for us to encourage the development of software that meets carefully considered educational standards. You talk about the next couple of years -- what I would like to see us do as a government, is establish the means by which we could provide concrete, and I hope substantial support for the development of courseware by people in this province. Courseware for use in our own schools, and good courseware that could be marketed nationally or internationally.

Q. I've got a two-fold question: Have you any plans to make an equivalent Black Apple for the central offices, because sooner or later all of these little pieces are going to have to start fitting together as we move toward the electronic world? Have you got something to say on non-structional side?

A. I'm not sure that they do fit together. I think of key word technologies in Calgary and the key word 7,000, as it has been described to me, it makes document files transportable from almost any machine and almost any piece of software to another machine and another piece of software. The industry in one way or another has got to find either translation software or translation devices, and I believe they will be successful in doing that. So I'm not a big believer that there has got to be hardware uniformity for the purpose that you describe. Another part of that though, would simply be to have the Department of Education develop certain standards for information that is communicated to us. Because if those standards were developed, then they would be picked up by all the boards in the province and would, as a result of that, establish a standard for a communication between boards, or from boards to universities. And that is certainly one thing that we want to do. I don't know if you can understand how deeply I can feel my own sense of frustration. I say on one hand that I am pleased with what we've accomplished, and on the other hand, there were certain things that I had in mind four years ago, that I thought would be done by now, and they're not. I've had a computer on my desk for six years, right in my office, and I keep on saying that I only want about three or four things. I would like us to have an electronic messaging system, so that anybody in the province -- parents with a computer in their home with a modem, superintendent, dean of a faculty -- could message me on a system that was clearly understood and easily operated. Then I could walk into my office in the morning and read the messages. I don't care what is happening anywhere else in the community. This is one of the most strongly integrated social institutions and social organizations that there is, the educational system, and we have still not found a way of providing ourselves with an electronic messaging system.

Second, I would like to have a bulletin board. Let's start off with the bulletins behind glass. We're the only ones who can put them up there, but anybody can read them. Last week we sent out an advisory bulletin to everybody in the province about the next step in what is called the secondary program of studies. It's released to the media on a morning in Edmonton; we put it in the mail to every superintendent in the province, and with the mail system the way it is, it might be received one day later or six days later. Now, in the meantime, local reporters have gone to the superintendent and said, what is this about the review of the secondary program of studies? The reply is, I don't know, my information is in the mail. Why can't we have a bulletin board system that would disseminate that information?

The third thing is teleconferencing. People are interested in special education; education for the gifted. Administrators are interested in transportation or finances, or whatever. Why can't we have broad chat conferences, where somebody says, "I'm dealing with this unit in social studies 20; really having a problem with it. Is there anybody out there who has a good idea about how to deal with this unit?" Why can't we offer conferencing systems like that for the teachers who want them? There's still lots to be done. I think I digressed from your question. The point is, that part of that has got to be done by the Department of Education. We are the principle collectors of information. We're the ones who should put the first information up on the bulletin board. And in the course of doing that properly, we would address your question.

Q. Has the department given any thought to providing a vehicle to offset long distance charges?

A. At the moment, because of the law, the only way to do that would be a cash subsidy. Telephone rates are regulated by the Public Utilities Board, and in their legislation they are only allowed to recognize two classes of rates; one for the residential non-business user, and the other one for the non-residential, which is to say the business user. The law doesn't allow them to recognize a third or a fourth category; say, for local government, or even for the provincial government, or a category for private non-profit organizations. We have initiated discussions with the Alberta Government Telephone Commission asking them to consider and react to us on the question of whether or not we should jointly urge an amendment to the Public Utilities Board Act to establish a third or perhaps even a fourth or fifth category of long distance charges.

Conclusion

I am excited by the fact that you are gathering here. I really do wish you the best during the balance of this meeting. What is important is not what happens here, but what we take back to our workplace. It is important that, whatever enthusiasm we generate here, we continue to share with each other, even if we are separated by miles, and that we continue to do the kinds of things that will allow us to reinforce the actions of all the rest of us. If you can figure out some effective ways of doing that, then I will be eternally in your debt.

Thank you very much.

January 31, 1986

PLENARY PRESENTATION

SYMPOSIUM - COMPUTERS IN SCHOOLS

January 31, 1986

John Travers:

I'd like to continue with the morning's activities. I'm sure you are aware that at the head table we have an additional guest who spoke to us at the outset of this Symposium, and I think gave us some very interesting and illuminating ideas as to where we might go in the future, rather than dealing just with day to day issues. There are a couple of visions that he left with us, and one of them, that I'm still thinking about, is something called the "organic database". That's an interesting visual analogy. Mr. King would like to say a few words to you this morning before he is due back at the Legislature. Mr. King.....

Mr. King:

Thank you very much John, and good morning ladies and gentlemen. I will be very brief because my office expects me back pretty quickly. I am very, very interested in and concerned about what you are doing, so I wanted to come back this morning, just to share a few minutes with you. I thought I would be sitting at the back of the room, but I came in during coffee break and had an opportunity to speak with some of you for just a few minutes, and became excited by some of the things I heard. So I thought that I would exercise a rare prerogative, and respond to a little bit of that excitement.

Remember what I said to you on Wednesday -- and I certainly don't want to take any of it back. But I do want to expand on part of it, because I walked away afterwards feeling just a little bit dissatisfied.

As I understand it, three things have come up time and time again in the last day and a half. One has been the need for people to communicate. Share information. Expand the knowledge base of the concerned and the committed.

The second one has been that we've still got to be very, very flexible. We still don't have an assurance about what conditions are going to be like five or ten years from now, and so we have got to be very, very nimble on our feet. And other people must allow those of us at the grass roots to be nimble on our feet, because if we are too tied down, then we are only going to trip.

The third thing that I hear talked about is the need for continued leadership; imagination; commitment; the determination that things should be done. It is the last one that I want to speak to you about very quickly, because I don't want any of you to think that my remarks to you on Wednesday afternoon were a giving up of the responsibilities of leadership, or tossing the ball to you and saying, "All right, I'm going to sit on the sidelines and watch what happens, and from now on, it is up to you." Nothing could be further from the truth.

My whole approach to politics was influenced by a book that I would commend to any of you. It is called "Leadership" by an American political scientist named R. McGregor Burns. He won a Pullitzer prize for it. He wrote some things that I'd never really seen written before about leadership. They are very, very important. One of the things he says is that leadership is not a description of the qualities of any man or woman. It is a description of the relationship that exists between someone we call a leader, and the community of which they are a leader. And I think that's very important. Leadership is not a description of the qualities of one person, whether the person gets that role by virtue of being elected, or by virtue of the power of their personality, or anything else. Leadership is a description of the quality of the relationship that exists between a leader and others in the community.

And the second thing he says, which is equally important, is that if you look into any situation, there are occasions when leaders are ahead of the community, and there are other occasions when the community is ahead of the leaders. And it is for precisely that reason that there must always be a relationship between the two of them. One can't savor the relationship between the leader and the others. He uses examples from the life of Ghandi and Roosevelt and Stalin. He says that, at one point, Roosevelt was ahead of the American community, and at other times the American community was ahead of Roosevelt.

Whether I am the Minister of Education in six months, or someone else is the Minister of Education, you can be absolutely confident that the question of the injection of the computer into our community, especially our educational system -- the injection of the computer power into our educational system -- is so important to all of us, that when the Minister of Education understands where it's at -- and he'll see it in the outcome of this report, -- he will be able to see his way clear to make another day's journey through the forest or across the plain, and he will set out and do it.

I didn't want to suggest to you for a moment, that we had reached a point where Ministers or other politicians were going to stand back and say, you are on your own now, go to it. That's not the case. I repeat again what I said on Wednesday. We are all in this together, but we have reached the time where we need to understand exactly what breadth and depth of commitment, experience and skill is now available in the community as distinct from five years ago. And when I've got an understanding of that, then decisions will be made that will foster communication or networking, foster flexibility at the local level, and foster leadership at every level from the classroom to the university community, to the Minister's office. I just want to assure you that's the case, and we are going to go on together.

Thanks very much, and every success with the balance of the morning, and with carrying the message back to your community.

DESIGNING AND EQUIPPING INSTRUCTIONAL FACILITIES

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INTRODUCTION

Enclosed is a set of questions to consider when designing and equipping instructional facilities for microcomputers.

Since no one set of recommendations can be developed for all placements, a continuum has been developed to reflect different requirements and layouts. It is expected that designers, administrators, and teachers first agree on the instructional area requirements and long-range curriculum implementation plans, and then work through the questions.

The questions address three facility requirements: the student station, the room area, and the building All questions are open-ended and responses must reflect program needs, and the philosophical rationale defining the teaching methodology.

I. NO LAB

A. Assigned Microcomputer Per Classroom

Student Station:

1. What is the "foot print" of the selected hardware: computer, printer, disk drives, monitor, modem, plotter, digitizer, copy stands, and flip sorts?

2. What hardware comprises the present student station?

   What are the projected additions to the student station?

3. What are the furniture requirements: moveable desk, fixed desk, chair, and/or cart?

4. What are the furniture specifications: typing height, chair height, and work surface?

5. Is it cheaper to build, contract, or purchase the required furniture?

   What quality of furniture is required when considering the life cycle of the hardware?

Room and Building:

1. What is the available space per classroom for permanent placement?

2. What are the storage requirements for software, paper, and disks?

3. What are the electrical requirements: surge suppression and voltage clamping, constant voltage, noise filtration, number of power outlets, number of power switches and/or power bars?

4. What are the effects of blackboard dust on hardware? Are grease boards or dust covers required?

5. What problems are caused by static electricity from installed carpet? Are anti-static mats or humidifiers required? Should carpet be replaced with tile?

6. What are the lighting requirements? What is the better choice: fluorescent or incandescent? Are dimmer switches required?

7. What is the effect of natural lighting? Are blinds required for existing windows?

8. What are the projected requirements for telephone lines for modems? Where does the conduit run and to what locations?

9. What are the required security precautions?

10. What are the projected renovation costs?

    What are the projected total costs -- hardware and software excluded?

B. Microcomputers on Moveable Carts

Student Station:

1. What is the "foot print" of the selected hardware: computer, printer, disk drives, monitor, modem, plotter, digitizer, copy stands, and flip sorts?

2. What hardware comprises the present student station?

   What are the projected additions to the student station?

3. What are the furniture requirements: cart with locking casters and power bar, chair?

4. What are the furniture specifications: typing height, chair height, and work surface?

   What is the projected utilization ESC to 12, or other situations?

5. Is it cheaper to build, contract, or purchase the required furniture?

   What quality of furniture is required when considering the life cycle of the hardware?

Room and Building:

1. What is the available space per classroom to allow periodic placement of units?

   How many units can be moved into a classroom?

2. What are the storage requirements for software, paper, and disks?

3. What are the electrical requirements: surge suppression and voltage clamping, constant voltage, noise filtration, number of power outlets, number of power switches and/or power bars?

4. What are the effects of blackboard dust on hardware? Are grease boards or dust covers required?

5. What problems are caused by static electricity from installed carpet? Are anti-static mats or humidifiers required? Should carpet be replaced with tile?

6. What is the lighting requirements? What is the better choice: fluorescent or incandescent? Are dimmer switches required?

7. What is the effect of natural lighting? Are blinds required for existing windows?

8. What are the projected requirements for telephone lines for modems? Where does the conduit run and to what locations?

9. What are the required security precautions?

10. What are the building considerations for different elevations: steps or ramps? (What slope is required for a ramp?)

11. What is the central storage location for equipment?

12. What are the projected total costs -- hardware and software excluded?

II. A. Moveable Carts in Lab Environment - Floppy Disk

Student Station:

1. What is the "foot print" of the selected hardware: computer, printer, disk drives, monitor, modem, plotter, digitizer, copy stands, and flip sorts?

2. What hardware comprises the present student station?

   What are the projected additions to the student station?

3. What are the furniture requirements: carts with locking castor and power bar, chairs?

   How are carts kept stationary?

4. What are the furniture specifications: typing height, chair height, and work surface?

   Is a low profile designed better suited for lecture purposes?

   What is the projected utilization: ESC to 12, or other situations?

5. Are sound covers required for shared printers?

6. Is it cheaper to build, contract, or purchase the required furniture?

   What quality of furniture is required when considering the life cycle of the hardware?

Room and Building

1. What is the available space for semipermanent placement?

   How many units can be set up?

2. Are you considering renovation of an existing facility or a new plant design?

3. What is the required station orientation in the lab: one direction, left-hand or right-hand orientation?

4. What space is required for instructor access to student stations?

5. What walkways are required for efficient exit of all students?

6. Do planned walkways accommodate peripherals on portables?

7. What counter space is required for distribution of instructional materials?

8. What space is required for the teacher station: computer station, desk, file cabinet, chair, and/or personal shelving?

9. Should shared printers be partitioned off?

10. What are the garbage collection requirements?

11. What are the storage requirements for software, paper, and disks?

    Are fixed closets and cupboards with locks required? Should all locks be keyed the same?

12. What are the effects of blackboard dust on hardware? Are grease boards or dust covers required?

13. What are the locations for tack boards?

14. Where is the overhead screen?

15. Is a large video display required? At what location?

16. Where are doors positioned to facilitate multiple use of the facility?

17. Are separate air conditioning units or fresh air exchanges required to control heating problems?

18. What are the electrical requirements: surge suppression and voltage clamping, constant voltage, noise filtration, number of power outlets, power bars, number of electrical circuits, number of power switches for system units, and/or standard or keyed switches?

19. Where is the electrical conduit installed: floor, walls, drop from ceiling?

    Can you make use of existing business education floor conduit?

20. What problems are caused by static electricity from installed carpet? Are anti-static mats or humidifiers required? Should carpet be replaced with tile?

21. What are the lighting requirements? What is the better choice: fluorescent or incandescent? Are dimmer switches required?

22. What is the effect of natural lighting? Are blinds required for existing windows?

23. What are the projected requirements for telephone lines for modems? Where does the conduit run and to what locations?

24. What are the required security precautions?

25. What are the building considerations for different elevations: steps or ramps?

26. Should conduit be installed for future network requirements: coaxial, twisted pair, network cable?

27. What are the projected renovation costs?

    What are the projected total costs -- hardware and software excluded?

B. Moveable Carts in Lab Environment - File Server

Student Station:

1. What is the "foot print" of the selected hardware: computer, printer, disk drives, monitor, modem, plotter, digitizer, and copy stands?

2. What hardware comprises the present student station?

   What are the projected additions to the student station?

3. What are the furniture requirements: carts with locking castor and power bar, chairs?

   How are carts kept stationary?

4. What are the furniture specifications: typing height, chair height, and work surface?

   Is a low profile design better suited for lecture purposes?

   What is the projected utilization: ESC to 12, or other situations?

5. Are sound covers required for shared printers?

6. Is it cheaper to build, contract, or purchase the required furniture?

   What quality of furniture is required when considering the life cycle of the hardware?

Room and Building:

1. What is the available space for semipermanent placement?

   How many units can be set up?

2. Are you considering renovation of an existing facility or a new plant design?

   If renovating an existing facility, is it cheaper to strip a room and start again?

3. What is the required station orientation in the lab: one direction, left-hand or right-hand orientation?

   Does the plan include islands and/or perimeter usage?

4. What type of network is selected? What are the cable requirements and to what locations? How many cables per location?

   Should conduit be installed for cabling?

5. Where should the file server be located? What security precautions are required for the file server?

6. What space is required for instructor access to student stations?

7. What walkways are required for efficient exit of all students?

8. Do planned walkways accommodate peripherals on portables?

9. What counter space is required for distribution of instructional materials?

10. What space is required for the teacher station: computer station, desk, file cabinet, chair, and/or personal shelving?

11. Should shared printers be partitioned off?

12. What are the garbage collection requirements?

13. What are the storage requirements for software, paper, and disks?

    Are fixed closets and cupboards with locks required? Should all locks be keyed the same?

14. What is the effect of blackboard dust on hardware? Are grease boards or dust covers required?

15. What are the locations for tack boards?

16. Where is the overhead screen?

17. Is a large video display required? At what location?

18. Where are doors positioned to facilitate multiple use of the facility?

19. Are separate air conditioning units or fresh air exchanges required to control heating problems?

20. What are the electrical requirements: surge suppression and voltage clamping, constant voltage, noise filtration, number of power outlets, power bars, number of electrical circuits, number of power switches for system units, and/or standard or keyed switches?

21. Where is the electrical conduit installed: floor, walls, drop from ceiling?

    Can you make use of existing business education floor conduit?

22. What problems are caused by static electricity from installed carpet? Are anti-static mats or humidifiers required? Should carpet be replaced with tile?

23. What are the lighting requirements? What is the better choice: fluorescent or incandescent? Are dimmer switches required?

24. What is the effect of natural lighting? Are blinds required for existing windows?

25. What are the projected requirements for telephone lines for modems? Where does the conduit run and to what locations?

26. What are the required security precautions?

27. What are the building considerations for different elevations: steps or ramps?

    What slope is required for a ramp?

28. What are the projected renovation costs?

    What are the projected total costs -- hardware and software excluded?

III. A. Fixed Lab - Stand Alone Stations

Student Station:

1. What is the "foot print" of the selected hardware: computer, printer, disk drives, monitor, modem, plotter, digitizer, copy stands, and flip sorts?

2. What hardware comprises the present student station?

   What are the projected additions to the student station?

3. What are the furniture requirements? Are L-shaped tables required?

   What is preferable, a horizontal or vertical orientation of the system unit?

4. What are the furniture specifications: typing height, chair height, and work surface?

   Is a low profile design better suited for lecture purposes?

   What is the projected utilization: ESC to 12, or other situations?

5. Are sound covers required for shared printers?

   Are shared printers and peripherals on moveable carts?

   Should the printer paper be off the floor?

6. Is it cheaper to build, contract, or purchase the required furniture?

   What quality of furniture is required when considering the life cycle of the hardware?

Room and Building

1. What is the available space for permanent placement?

   How many units can be set up?

2. Are you considering renovation of an existing facility or a new plant design?

   If renovating an existing facility, is it cheaper to strip a room and start again?

3. What is the required station orientation in the lab: one direction, left-hand or right-hand orientation?

   Does the plan include islands and/or perimeter usage?

4. What space is required for instructor access to student stations?

5. What walkways are required for efficient exit of all students?

6. Do planned walkways accommodate peripherals on portables?

7. What counter space is required for distribution of instructional materials?

8. What space is required for the teacher station: computer station, desk, file cabinet, chair, and/or personal shelving?

9. Should shared printers be partitioned off?

10. What are the garbage collection requirements?

11. What are the software requirements for software, paper, and disks?

    Are fixed closets and cupboards with locks required? Should all locks be keyed the same?

12. What is the effect of blackboard dust on hardware? Are grease boards or dust covers required?

13. What are the locations for tack boards?

14. Where is the overhead screen?

15. Is a large video display required? At what location?

16. Where are doors positioned to facilitate multiple use of the facility?

17. Are separate air conditioning units or fresh air exchanges required to control heating problems?

18. What are the electrical requirements: surge suppression and voltage clamping, constant voltage, noise filtration, number of power outlets, power bars, number of electrical circuits, number of power switches for system units, and/or standard or keyed switches?

19. Where is the electrical conduit installed: floor, walls, drop from ceiling?

    Can you make use of existing business education floor conduit?

20. What problems are caused by static electricity from installed carpet? Are anti-static mats or humidifiers required? Should carpet be replaced with tile?

21. What are the lighting requirements? What is the better choice: fluorescent or incandescent? Are dimmer switches required?

22. What is the effect of natural lighting? Are blinds required for existing windows?

23. What are the projected requirements for telephone lines for modems? Where does the conduit run and to what locations?

24. What are the required security precautions?

25. Should conduit be installed for future network requirements: coaxial, twisted pair, network cable?

26. What are the projected renovation costs?

    What are the projected total costs -- hardware and software excluded?

B. Fixed Lab - Network

Student Station

1. What is the "foot print' of the selected hardware: computer, printer, disk drives, monitor, modem, plotter, digitizer, and copy stands?

2. What hardware comprises the present student station?

   What are the projected additions to the student station?

3. What are the furniture requirements? Are L-shaped tables required?

   Which is preferable, a horizontal or vertical orientation of the system unit?

4. What are the furniture specifications: typing height, chair height, and work surface?

   Is a low profile design better suited for lecture purposes?

   What is the projected utilization: ESC to 12, or other situations?

5. Are sound covers required for shared printers?

   Should the printer paper be off the floor?

6. Is it cheaper to build, contract, or purchase the required furniture?

   What quality is required when considering the life cycle of the hardware?

Room and Building:

1. What is the available space for permanent placement?

   How many units can be set up?

2. Are you considering renovation of an existing facility or a new plant design?

   If renovating an existing facility, is it cheaper to strip a room and start again?

3. What is the required station orientation in the lab: one direction, left-hand or right-hand orientation?

   Does the plan include islands and/or perimeter usage?

4. What type of network is selected? What are the cable requirements and to what locations? How many cables per location?

   Should conduit be installed for cabling?

5. Where should the file server be located? What security precautions are required for the file server?

6. What type of switching mechanism is required to monitor student stations from the instructor station?

7. What space is required for instructor access to student stations?

8. What walkways are required for efficient exit of all students?

9. What counter space is required for distribution of instructional materials?

10. What space is required for the teacher station: computer station, desk, file cabinet, chair, and/or personal shelving?

11. Should shared printers and peripherals be partitioned off?

12. What are the garbage collection requirements?

13. What are the storage requirements for software, paper and disks?

    Are fixed closets and cupboards with locks required? Should all locks be keyed the same?

14. What is the effect of blackboard dust on hardware? Are grease boards or dust covers required?

15. What are the locations for tack boards?

16. Where is the overhead screen?

17. Is a large video display required? At what location?

18. Where are doors positioned to facilitate multiple use of the facility?

19. Are separate air conditioning units or fresh air exchanges required to control heating problems?

20. What are the electrical requirements: surge suppression and voltage clamping, constant voltage, noise filtration, number of power outlets, power bars, number of electrical circuits, number of power switches for system units, and/or standard or keyed switches?

21. Where is the electrical conduit installed: floor, walls, drop from ceiling?

    Can you make use of existing business education floor conduit?

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23. What are the lighting requirements? What is the better choice: fluorescent or incandescent? Are dimmer switches required?

24. What is the effect of natural lighting? Are blinds required for existing windows?

25. What are the projected requirements for telephone lines for modems? Where does the conduit run? To what locations?

26. What are the required security precautions?

27. What are the projected renovation costs?

    What are the projected total costs -- hardware and software excluded?

CLOSING COMMENT

It is recognized that a major problem when designing instructional facilities is available space. Many schools do not have adequate space to construct the required instructional facility.

In many circumstances a room is designated. Subsequent decisions reflect the limitations of the existing structure, and may not reflect what is required.

This document has not addressed facility requirements for administration and teacher preparation areas.

CREDITS

This document is a summary of discussions with teachers, administrators, and maintenance personnel in Yellowhead School Division No. 12. The instructional facility continuum evolved based on the analysis of program need.

PLANNING AND DESIGNING
SCHOOL COMPUTER FACILITIES
INTERIM REPORT
NOVEMBER 1985

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PREFACE

School computer facilities are a new phenomenon, and as such represent an exciting challenge to facility planners and designers. This publication, Planning and Designing School Computer Facilities, is intended to help meet this challenge, through providing suggestions and considerations that will be useful in developing facilities for computers in schools. The report emphasizes facility planning considerations as well as design requirements and criteria, so that it will assist in the design and implementation of the specific school computer facilities required to fulfill local educational needs.

Planning and designing school computer facilities is a new and rapidly developing expertise. Experience and knowledge is being gained almost daily by those providing school computer facilities throughout the province. This study is being brought forward as an interim report and circulated for use and review by interested individuals to draw upon this first-hand experience. Suggestions and contributions you may wish to make are welcomed for inclusion in a second edition to be published in one year. It is our intent that the second edition contains more specific and detailed information and be revised through feedback from users.

ACKNOWLEDGMENTS

This report was prepared by Walter J. Heppler, M. Ed., a research consultant to Alberta Education.

Appreciation is expressed to the many school systems who responded to requests for suggestions and concerns related to the planning and designing of school computer facilities. In particular the contributions are acknowledged of Gordon Branson (Calgary Public Schools), J.J. Gleason (Lethbridge Catholic Separate School District No. 9) and W. Evdokinoff and Wayne E. Krywolt (Lethbridge Community College) who provided tours of their facilities and insight into their planning and design experiences.

John Kulba, Marian Weleschuk and D. Robert Fiedler (Alberta Education, School Buildings Services) provided motivation and valuable advice and assistance. Steve Kashuba, Sharon Prather, Warren Hathaway (Alberta Education) and Morley Workun (McIntosh, Workun & Chernenko Architects Limited) critiqued the document draft. Dixie Anderson (Alberta Education Library) provided valuable assistance with the literature review.

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SECTION I

INTRODUCTION

A. PURPOSE AND SCOPE

The purpose of this publication is to provide suggestions and considerations which may be useful for school jurisdictions developing facilities for computers in schools. It is intended to assist school system planners in clarifying the educational specifications necessary for them to give adequate direction to architects, other design consultants and purchasers involved in the design and implementation of school computer facilities.

In Part II of this document emphasis is placed on planning considerations while Part III focuses on design requirements and criteria. Part II discusses the following: planning process, needs assessment, computer locations, security, health and safety concerns, hardware and software considerations, maintenance and operation, and budget aspects. In Part III attention is given to: design of workstations, laboratory configurations, and to architectural, electrical and mechanical design criteria. Sketches are provided to assist in clarifying the concepts discussed.

Detailed consideration of software and hardware selection criteria and provisions for maintenance are beyond the scope of this document. Hardware and software references have been restricted to impacts on building planning and design.

B. LIMITATIONS

While a survey of the literature in the last five years in North America, Britain and Australia has been carried out during the preparation of this publication, the results have been meagre in the finding of research which provides hard data relating directly to school computer facility design. The user of this document should be aware that the suggestions provided are largely based on studies in office automation and so they are largely untested and unevaluated in the school and classroom setting.

SECTION II

PLANNING SCHOOL COMPUTER FACILITIES

A. THE PLANNING PROCESS

1. Planning Phases

If planning for school computer facilities is not to be haphazard, it should be carried out in accordance with a planning model. This model should address questions of the school's needs, the purpose of the computer facility, specific plans to achieve an operational facility and maintenance requirements. Lundgren and Garrett (1985) provide a checklist or outline encompassing four phases: study phase, design phase, development phase and an operation phase. This outline is reproduced in Table 1. A model such as this one will assist in ensuring that important considerations have not been overlooked.

2. The Planning Team

School computer facility planning requires a variety of expertise. For this reason, consideration should be given to establishing a planning team along the following lines:

Study Phase:	representatives of central and school administration (one to be designated as "team coordinator"), teachers, local and provincial curriculum consultants;
Design Phase:	architect, electrical and mechanical consultants, facilities manager, equipment suppliers and Study Phase team members;
Development Phase:	purchasing agents, suppliers and Study Phase team members;
Operation Phase:	representatives of school administration and users.

TABLE I
MICROCOMPUTER LABORATORY OUTLINE

I. STUDY PHASE: Analysis of Needs

A. Major Considerations
  1. Statement of Purpose
     Administrative, curricular, community, and extracurricular
  2. Utilization Profile
     Number of individuals and peak usage
  3. Current and Future Funding Commitment
     Hardware and software purchases; staffing

B. Study Phase Report
  1. Statement of Purpose and Direction
  2. Summary of Accomplishments to Date
  3. General Recommendations

II. DESIGN PHASE: System Design

A. Design Ideal Configuration
  1. Computer Hardware
     Number of stations, minimal capabilities, software and service availability, peripherals, security, and compatability considerations
  2. Software
     Functional type specifications, proprietary considerations, and security
  3. Network Configuration
     Full networking including peripherals, partial networking, stand-alone
  4. Physical Laboratory Facilities
     Space, size and storage considerations, ergonomics, safety, ambient temperature control, and the electronic environment
  5. Supervision
     Students, paraprofessional, or professional supervisors
  6. Policies and Procedures
     Scheduling access policies and procedures, and management/security (disk/paper)

B. Cost Estimating
   Hardware, Software, Environment, and Personnel

C. Cost/Benefit Analysis

D. Design Revision (as necessary)

E. Final Design Phase Report

III. DEVELOPMENT PHASE: System Implementation

A. Purchasing

B. Installation and Testing

C. Training/Orientation (Lab Directors/Supervisors)

D. Final Development Project Report

IV. OPERATION PHASE: Evaluation and Maintenance

A. Hardware/Software Replacement Plan

B. Policies for Upgrading Software/Hardware

C. Evaluation Instruments and Intervals

D. Procedures for Equipment in Service

E. Annual/Quarterly Report

(Lundgren and Garrett, 1985)

B. NEEDS ASSESSMENT

In carrying out a needs assessment attention should be given to the functions or purposes intended for the facility. Further, the potential users must be identified as well as the activities in which they will be engaged while using the facility.

1. Functions Served

A study of the purposes or functions which will be served by the school computer facility should carefully examine the instructional uses which will be served, and whether other than instructional uses will be made. In particular, will the facility also be employed for administrative and/or recreational uses? A definition of potential uses will have an important bearing on security, access and location planning for the facility as well as on hardware and software needs. Will the facility be used outside of ordinary school times? What courses will be offered in the facility?

2. Users to be Served

A description should be made of potential facility users. Included in the description should be: age range, total and peak usage numbers, type of user (students, non-students, users with physical handicaps, casual users), mode of use (singly, groups, classes). The result should be a utilization profile which will assist in determining facility size, location, furniture sizes and configuration, policies on scheduling, supervision and security. An analysis of the utilization profile should lead to a consideration of priorities which may need to be established.

3. User Activities

Depending on the functions to be served and the types of users, the activities which will occur in the facility may vary. Will the facility be used for both teaching and practice or for either alone? Will it be used for data entry and for retrieval for administrative purposes? Table 2 contains a listing of possible student and teacher activities to be considered. An analysis of user activities will assist with designing workstation and computer laboratory configurations.

TABLE 2

USER ACTIVITIES

Student Activities	**Teacher Activities**
Data entry	Data entry
Text entry/edit	Text entry/edit
Information retrieval	Information retrieval
Reading non-VDT material	Reading non-VDT material
- printouts	- printouts
- textbooks	- textbooks
- projected material	- projected material
Listening	Listening
- to teacher	- to student(s)
- to other student(s)	- to recorded material
- to recorded material	
Speaking	Speaking
- to teacher	- to student(s)
- to other students	
Writing	Writing
- note taking	
- editing printouts	
- flow-charting	- on overhead projector
- tests and exams	
Monitoring teacher activities	Monitoring student activities
- direct VDT observation	- direct VDT observation
- electronic VDT viewing	- electronic VDT viewing

C. LOCATION OF FACILITIES

Factors to be considered in locating computer facilities include balancing access requirements arising out of the needs assessment with security requirements. The latter concern will be discussed in the next section. A further factor which must be studied is the relative effectiveness of locating computers in particular school locations.

The Center for Social Organization of Schools of the Johns Hopkins University conducted the National Survey of School Uses of Microcomputers in 1983. This study encompassed 1,082 schools in the U.S.A. The effects of the location of microcomputers in schools is reported by Becker (1984). The review concluded the following:

- When computers are located only in classrooms, there is less, but more equitable use;
- The impact of having a computer laboratory is that there is more use with emphasis on programming;
- Where computers are located in the school library in secondary schools, there is less use than if they were located in a lab, but more use than if located in classrooms. Further, there are fewer different uses made of the computers and more of a balance between programming and drill and practice uses. In elementary schools with computers located in the library there was more balance in use between above-average and below-average students but less positive social outcomes. In the latter instance, student enthusiasm for computers was particularly low in elementary schools when computers were located in the media centre;
- Rotating microcomputers from room to room results in more access but less impact on students and schooling;
- Dispersing microcomputers around the school does not appear to be beneficial for elementary schools, but has certain benefits for secondary schools;
- In most cases, further research is required to discover the reasons for the effects noted in this study.

It is apparent that there is no single best solution to the question of location. The results of the research must be weighed in relation to the school's objectives for its computer programs. A summary of the Becker study is given in Table 3.

TABLE 3

SUMMARY: IMPACT OF MICRO LOCATIONS ON PATTERNS OF USE

Note: Each row-column combination has two entries. The Format is...

ELEMENTARY ENTRY / SECONDARY ENTRY. The entries are:

+ : Substantially More in These Schools Than in Other Schools

- : Substantially Less in These Schools Than in Other Schools

	Classrooms Only	Computer Lab	Library	Rotate Micro Between Rooms	Dispersed Locations
Number of Regular Teacher Users	- / -	+ / +	/ +	/ +	/ +
Number of Hours Per Week of Student Use	/ -	+ / +	/	/ +	- /
Breadth of Use Across 13 Applications	- /	/ +	/ -	/	/ +
Percent of Students Who Use Micro	/	+ /	/ +	+ / +	/ +
Dominance of Computer Programming Uses Over Drill-and-Practice	- / -	+ / +	/ -	- /	+ / -
Equity Between Above-Average and Below-Average Students' Use	/ +	- / -	+ /	+ /	/
Computer Time Per Student User	- / -	/ +	/	- /	- /
Academic Learning Attributed To Micro Presence	/	/	- /	- /	/
Social and Organizational Outcomes Attributed to Microcomputer	/	/	- /	- / -	- /

(Becker, 1984)

D. SECURITY AND LEGAL CONSIDERATIONS

The need for computer security only arises if there is something valuable associated with computers which needs to be protected. Protection should be considered for the following reasons: eliminating unauthorized use (hardware, software, data, phone links), securing (maintaining) accuracy of data for instructional and/or administrative use, maintaining confidentiality of certain data (student records), replacing stolen or vandalized software/hardware, eliminating loss of instruction time when loss occurs (particularly to senior high students in semestered computer courses) and reducing loss or waste of staff time while computers are out of service. The local cost of some types of loss can be minimized by adequate insurance but even in these cases the insurance cost is eventually borne by the community generally. Special provisions must be made, however, to provide viable alternatives for teachers and students in the event of extended unavailability of school computers.

1. Threat Assessment

Because security provisions are a cost item, it is important that resources allocated to security be directed to those areas where there is a high cost/benefit. To determine such areas, a threat assessment should be carried out which identifies the nature of the threat, assigns a probability of an actual breach of security and estimates the resulting level of loss. The resulting index of exposure will identify the highest cost/benefit security factors. A suggested format for carrying out a threat assessment is contained in Table 4. More extensive approaches are contained in the security system review manual published by the American Federation of Information Processing (AFIPS) cited in the references at the end of this publication.

2. Review of Existing Security

With the threat assessment in hand, a review of existing security arrangements and plans should be made to identify strengths and weaknesses.

3. The Security Plan

A written security plan should be developed. This plan should be directed at protecting data, software and hardware from theft and harm by restricting physical access to authorized persons, providing locks on doors and windows, providing intrusion alarms, securing terminals to furniture, preventing physical access to internal parts of computers, and keeping back-up copies of programs and data and storing them separately.

A contingency plan for loss or failure of computers should be developed by pre-arranging replacement or access to alternative computer sites in cooperation with other schools and equipment suppliers.

The security plan should also give consideration to controls on electronic access by means of passwords, screening of dial-ups prior to log-on, and by shutting off for specified times electronic access to the computer. Controls should also be placed on access to outside on-line data bases and financial controls on telecommunications (long distance) charges.

4. Legal Aspects of Security

A review of current cases and proposed legislation (Kingston, 1985) indicates that the courts will not protect computer owners who have not made reasonable security provisions. Bill C-18 will amend the Criminal Code of Canada to make it a crime to wilfully destroy, alter or interfere with the use of data. It will also make it an offence to knowingly without authorization obtain a computer service, intercept a function of a computer system, and to use a computer to do either of the above. Recent court cases have established that confidential information is property, that a list (data or program) compiled on a computer is subject to copyright. In the U.S. companies have been held liable for unauthorized copying of programs by employees.

Policy should be developed to ensure compliance with licence and copyright agreements for print material and software which accompany the purchase of such materials. Failure to comply with such, often implicit, agreements could result in breach of contract with the vendor.

TABLE 4

SUGGESTED THREAT ASSESSMENT FORMAT

Threat	Probability (P) Of Occurrence High 3 Moderate 2 Low 2 None 0	Level of Loss (L) High 3 Moderate 2 Low 1 None 0	Exposure(E) (P x L)
	P	L	E
NATURAL			
Wind			
Earthquake			
Fire			
Flood			
Other			
MAN-MADE			
Fire/Water			
Riot			
Strike			
Accident			
Loss of Utilities			
HOSTILE ACTION			
Theft			
Fraud			
Mischief			
Sabotage			
SYSTEM UNRELIABILITY			
Hardware			
Software			
Applications			
Communications			
Human Errors			

Note: In calculating level of loss consideration should be given to cost of replacement of hardware, software, time to rebuild lost data and text, and lost staff time and instruction time of students. For items indicating high exposure, level of loss should be estimated in dollars per year. This amount would indicate the upper limit of investment in prevention which would provide a benefit.

5. Policy Requirements

It is suggested (Jeffrey, 1985) that a security plan be part of an official information policy which addresses information management, the privacy of information, use of computer resources and access to information. The policy should define what is sensitive and to be protected as well as the penalty for infringement. It should further provide for regular communication of the policy to all computer users.

E. HEALTH AND SAFETY CONSIDERATIONS

There has been a good deal of public discussion concerning health effects of video-display terminal use. This prompted the U.S. National Institute for Organizational Safety and Health (NIOSH) to survey the health complaints associated with VDT use. The results indicated a significantly larger number of health complaints among VDT users as compared with control subjects. The results of the survey are contained in Table 5. The report included recommendations for adult computer stations which are contained in Table 6. The significance of these findings for school facility planning is stressed by Yeaman (1983) who foresees considerable resistance to computer use by students developing in the long term if facilities planning disregards student health concerns. This will require the application of human factors research (ergonomics) to the planning of school computer facilities.

Unfortunately, little research has been done regarding the physical arrangements required by children using micro-computers. While it can be argued that students will not be spending as much time with computers as do business operators, Yeaman notes that student physical and psychological immaturity is likely to intensify the stress induced by the body rigidity brought about with use of a computer screen and keyboard.

The best that can be done until more research results on child ergonomics become available is to adapt the NIOSH recommendations to the school situation. Yeaman further suggests that students should be taught to adjust workstations; that complaints of discomfort by students be taken seriously; that time limits and rest breaks be incorporated into class routines; and that students be advised to have vision testing as computer use reveals undetected vision problems and vision complications for students wearing glasses or contact lenses.

Underlying the facility planning approach should be the ergonomic principle of requiring the facility to be adaptable to the person rather than requiring the person to adapt to the facility.

TABLE 5

PERCENTAGE OF CLERICAL VDT OPERATORS AND CONTROL SUBJECTS WITH SELECTED HEALTH COMPLAINTS

Health Complaints	Percentage	
	Clerical VDT	Control Subject
Skin Rash	57	31
Irritability	80	63
Fainting	36	17
Nervousness	50	31
Fatigue	74	56
Pain Down Arm	36	20
Stomach Pains	51	35
Change in Color Perception	40	9
Irritated Eyes	74	47
Burning Eyes	80	44
Blurred Vision	71	35
Eye Strain	91	60
Swollen Muscles and Joints	50	25
Back Pain	78	56
Painful or Stiff Arms or Legs	62	35
Painful or Stiff Neck or Shoulders	81	55
Numbness	47	18
Neck Pressure	57	34
Difficulty with Feet from Standing Long Periods	49	35
Sore Shoulder	70	38
Loss of Feeling in Wrists or Fingers	33	11
Neck Pain into Shoulder	56	19
Hand Cramps	49	16
Loss of Strength in Arms or Hands	36	14
Stiff or Sore Wrists	47	7

(NIOSH, 1981)

TABLE 6

NIOSH RECOMMENDATIONS FOR ADULT COMPUTER STATIONS (VIDEO DISPLAY TERMINALS)

Workstation Design Features

Chair. The chair should have a seat pan which is adjustable in height. The mid-back or lumbar region should be provided with support by a back rest. The feature of height adjustment is desirable, as is a setting for tension. Stability is provided by a base resting on five castors.

Leg Clearance. Leg clearance between knees and counter is essential.

Footrest. Footrests are very necessary for short users.

Keyboards. The height of all keyboards should be adjustable. Each keyboard should be between 0.74 and 0.79 meters above the floor, as measured from the home row on the keyboard.

Optical Concerns

Viewing Distance. The eye to screen distance should be variable between 0.45(18 in.) and 0.5(20 in.) meters. The viewing distance should be comfortable and adjustable to each viewer's needs. The keyboard and copyholder for frequently referred to documents should be in the same plane as the screen and of the same viewing distance. This prevents visual fatigue from continuous refocusing. The copyholder is indispensable in word processing and similar activities.

Viewing Angle. The screen's top edge should be no higher than eye level - 0 degrees - and no more than 40 degrees below. The ideal range is for the center of the screen to be at 10 degrees - 20 degrees below the horizontal plane at the user's eye height. The screen should be at a right angle to the line of sight - just like a book.

Lighting Level. For reading computer screens, the lighting level should be a third to a half of that normally used for reading printed paper. A level between 500 and 700 lux (45 to 65 foot-candles) would be correct for reading both. The print to background contrast minimum is 5:1. Brightness and contrast of the screen should be accessible for adjustment to each user's needs.

Lighting Contrast. The luminance ratio within the user's field of vision should be 1:3 in the center - the desk area - and not exceed 1:10 in the periphery - the room. Surfaces which reflect highly should be eliminated. Cutting down reflectivity through the excessive use of dark colours is not in order because dark colours may generate negative emotions.

Reflective Glare. Reflective glare (See Figure 2) is undesirable since it causes eye fatigue. To eliminate reflective glare, there are three mandates:

(1) Windows should be shaded;
(2) Screens should be positioned so as not to reflect windows or overhead lights; and
(3) The viewing direction of the user should run parallel to such light sources and avoid direct glare.

If reflective glare is still present, there are remedial steps:

(1) Full or partial screen hoods may be fitted;
(2) Anti-glare filters may be attached to the screens:
(3) Fluorescent light fixtures may need to be recessed; baffles may have to be added to cause more even diffusion of light by directing the light downward; and
(4) An indirect lighting system may have to be installed.

(NIOSH, 1981)

F. HARDWARE CONSIDERATIONS

The specifications of computer hardware, communications and networks selected for use in a school computer facility have important ramifications for furniture design, architectural design, and for electrical and mechanical requirements. For these reasons it is recommended that a representative of the hardware supplier be part of the facility planning team. This implies that the hardware supplier should be selected or determined prior to commencement of detailed facility designing and specification development.

G. OPERATION AND MAINTENANCE CONSIDERATIONS

Attention to operation and maintenance concerns needs to be addressed in school computer facility planning.

1. Custodial Requirements

Furniture and room layout planning should take into consideration the elimination of features which reduce the efficiency and effectiveness of computer facility custodial service. Because poor air cleanliness directly affects the operation of disc drives in particular, dust control becomes an important planning factor.

2. Hardware Maintenance

Provision should be made for space and equipment needed by school staff to carry out necessary preventive maintenance and equipment adjustments. Such space may also be required for major maintenance to be carried out on-site by out-of-school staff or by servicing agencies. It is suggested that a comprehensive maintenance plan be developed as part of the planning process for a school computer facility.

3. Software Maintenance

Because software may require maintenance to correct errors of design, logic and coding, or to make changes to adapt to changing requirements or to implement enhancements, space and access (electronic and physical) need to be provided for programmers to work. Again, attention should be given to developing a software maintenance plan as part of the planning process.

H. BUDGET CONSIDERATIONS

Successful implementation of a plan to operate a computer facility requires an adequate budget which considers a comprehensive range of cost factors both in the immediate and in the long range. While outlays for computer hardware are significant in comparison to other forms of educational technology many other related costs must be considered. Among these Hales (1984) notes the following:

1. Hardware, including cabling and accessories and shipping.
2. Software, including applications and licence fees.
3. Installation of hardware and software including utility hookups, air conditioning, fire protection, furniture and vendor fees.
4. Training fees and expenses for staff.
5. Maintenance of hardware and software.
6. Supplies, paper, forms, printer ribbons, etc.
7. Utilities including, power, water, sewer, telephone and data lines.
8. Insurance on computer system, software and data.
9. Personnel.
10. System selection and evaluation costs.
11. Data entry to load up the system data base initially.

The emergence of the micro-computer on the school scene is too recent to provide hard data on relative costs of the factors noted above. Torok (1984) does provide the following rule of thumb:

HARDWARE $$$ = SOFTWARE $$$ and,
HARDWARE $$$ + SOFTWARE $$$ = MAINTENANCE $$$ + ENVIRONMENT $$$

This relationship remains to be tested over time in the school setting. It does however suggest a possible level for investment in the computer facility in relation to hardware and software costs.

SECTION III

DESIGNING SCHOOL COMPUTER FACILITIES

A. STUDENT WORKSTATION DESIGN

Student workstations must be designed to support the efficient carrying out of user activities. A summary of these activities was provided in Table 2. Depending on the nature of the users and the program in which they are involved, some or all of these activities will come into play. Ergonomic studies of some of these activities suggest that a moveable keyboard and screen can be arranged in different ways to accommodate their use as well as the use of related documents. The Canadian Business Equipment Manufacturers Association (CBEMA 1983) in its publication "Ergonomics for Human Effectiveness and Well-being" provides an analysis of workstation equipment arrangements for the following activities: text and data entry, information retrieval, and alternate task activities some of which do not require VDT use. This analysis is summarized in Figure 1: Keyboard and Screen Arrangements.

Applying the dimensions typical of microcomputers used in schools to the arrangements described in Figure 1 suggests minimum top dimensions of 650 mm x 1000 mm (25 in x 40 in) for a student workstation to be used only for text and data entry and retrieval. Dimensions of 760 mm x 1220 mm (30 in x 48 in) would be preferable where extensive writing and reading of non-VDT material are also to be carried out. If the workstation will be used alternately for computer use and then for instruction not requiring computer use, the L-shaped configuration should be considered. Minimum outside dimensions of an L-shaped workstation should be 1220 mm x 1220 mm (48 in x 48 in) with inside dimensions of 610 mm x 610 mm (24 in x 24 in) with preferable dimensions of 1500 mm x 1500 mm (60 in x 60 in) and 750 mm x 750 mm (30 in x 30 in) respectively. (See Figure 2).

The NIOSH recommendations (Table 6) suggest that the height of the keyboard home row be in the range of 740 - 790 mm (29-32 in). For high profile (80 mm) (3 in) keyboards this would require a workstation height of 660 mm (26 in). New, low profile keyboards (25-40 mm) (1-1.5 in) will permit a workstation height of 700 mm (27.5 in) thus providing more knee space as well as a uniform workstation height for both writing and keyboard use. Footrests should be available for students who need them.

Further, it is suggested that a few fully-adjustable commercial workstations be acquired to accommodate physically handicapped students and to train all students in adjusting ergonomic workstations to enhance their comfort and productivity. Sample non-adjustable workstations are shown in Figure 2.

Student workstation design should provide for flexibility for grouping, and should facilitate individual assistance by the teacher. Adequate provisions should also be made for placement of peripheral hardware devices and for necessary cabling (See Electrical Design Criteria).

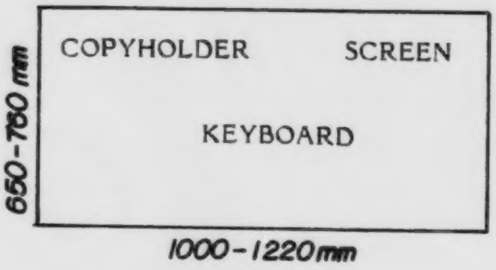
FIGURE 1

WORKSTATION KEYBOARD AND SCREEN ARRANGEMENTS

(CBEMA 1983)

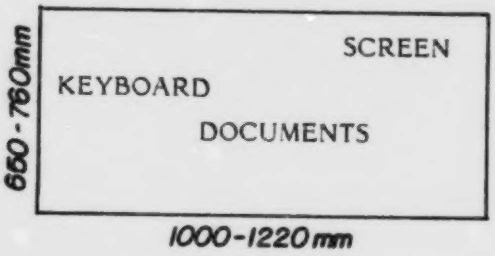
TEXT AND DATA ENTRY

Entering text or other data means intensive use of both hands. In the preferred position, the keyboard is directly in front of the operator and the screen and copyholder are side by side.


COPYHOLDER
SCREEN
KEYBOARD
650-760 mm
1000-1220mm

INFORMATION RETRIEVAL

Information retrieval often means using one hand on the keyboard while thumbing through documents with the other. Preference is for the keyboard slightly to one side and the screen to the other with note taking documents directly in front and between the keyboard and screen.


SCREEN
KEYBOARD
DOCUMENTS
650-760mm
1000-1220mm

ALTERNATE TASKS

An L-shaped work surface is well suited to an operator performing computer tasks and writing tasks alternately. This arrangement allows the operator to swivel the chair between tasks.

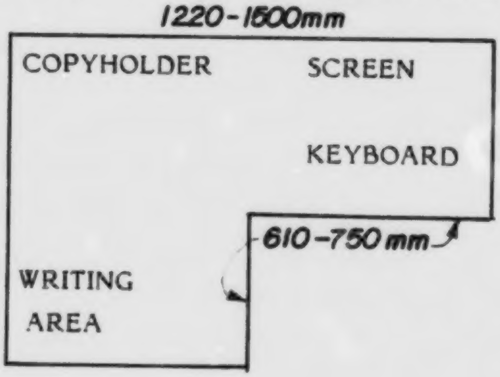
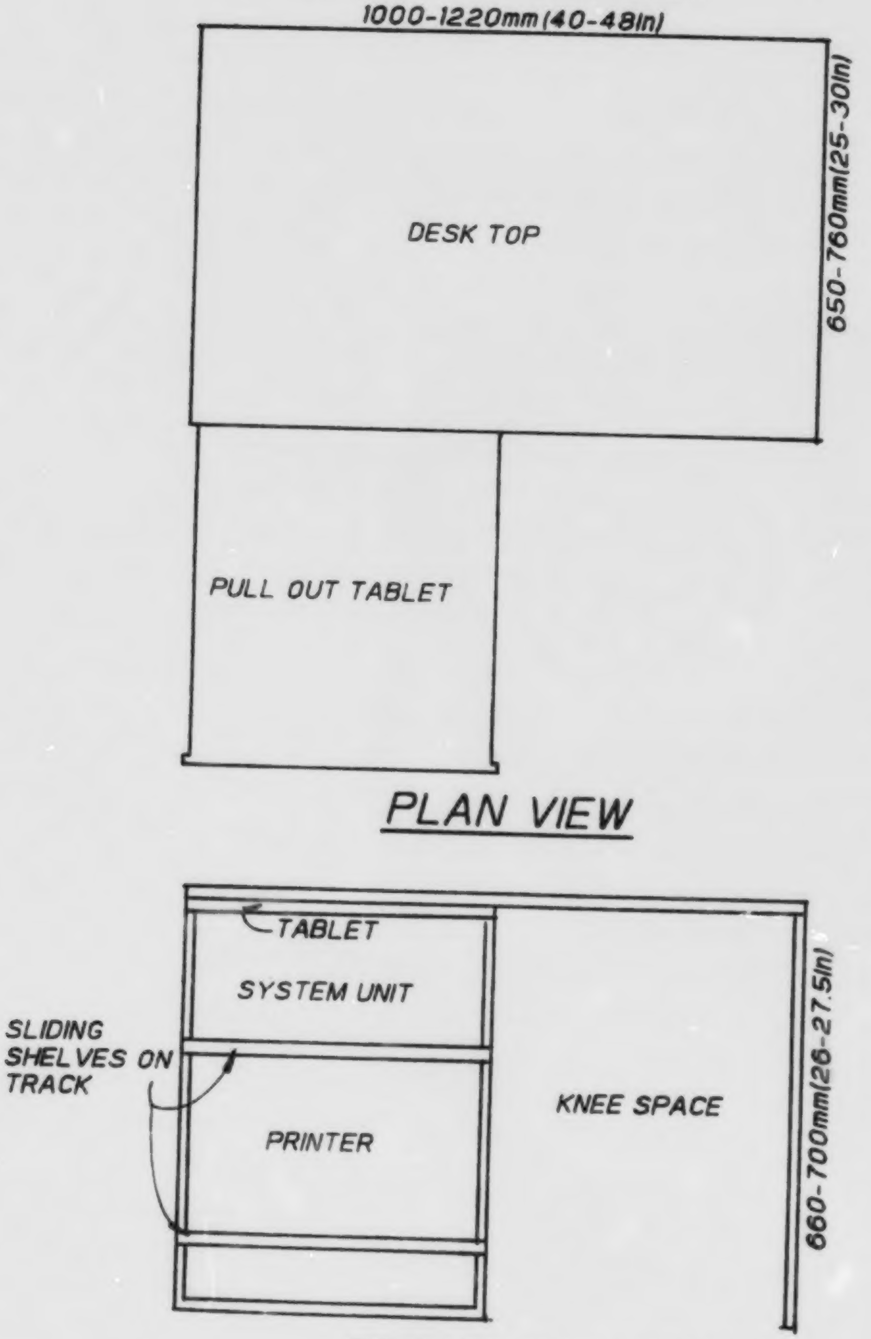

1220-1500mm
COPYHOLDER
SCREEN
KEYBOARD
610-750 mm
WRITING AREA

FIGURE 2

STUDENT WORKSTATION DESIGN


1000-1220mm (40-48in)
650-760mm (25-30in)
DESK TOP
PULL OUT TABLET
PLAN VIEW
TABLET
SYSTEM UNIT
SLIDING SHELVES ON TRACK
PRINTER
KNEE SPACE
660-700mm (26-27.5in)

FRONT ELEVATION

As important as the workstation design, is the selection of an ergonomically correct chair. Springer suggests the following criteria of good chair design:

1. Provision of anatomical support, "goodness-of-fit";
2. Support of working postures through a range of motion and easy transition from one task to the next;
3. Stability in any position.

He further notes that a workstation chair should have the following characteristics:

1. A rotatable, stable base with castors;
2. A contoured seat whose front edge curves downward to avoid cutting off leg circulation and whose rear curves upward to cradle the hips and pelvis;
3. The seat must not be too large: 400 mm (16 in) front to back and between 495-545 mm (19-21 in) wide;
4. Seat height should be adjustable a minimum range of 380-535 mm (15-21 in);
5. The backrest should have a forward curve to support the lumbar spine and an opening of 100-150 mm (4-6 in) between the backrest and the seat;
6. The entire backrest should adjust in height a minimum of 80 mm (3 in);
7. The backrest should pivot forward and backward from $+15^{\circ}$ to -35°;
8. If arms are provided, they should not be longer than 250 mm (10 in);
9. The chair covering should be a durable knitted fabric which permits air circulation and provides a non-slip surface;
10. User controls should be easy to locate and operate but not interfere with the operator or adjacent equipment.

B. COMPUTER LABORATORY DESIGN

1. Laboratory Configurations

Laboratory configurations should be designed to support effectively the user activities required by the programs being offered. Workstation orientation within the laboratory must accommodate both teacher and student activities (Table 2). Limitations on possible configurations appear to result from the teaching style adopted and from the grouping of students for instruction and practice.

If a laboratory is intended only as a computer resource room and speaking/listening activities are not a major occurrence, orientation of workstations does not present a significant problem. The objectives to be achieved relate to provision of adequate privacy between workstations, noise control, reduction of glare on VDT screens, accommodation of cabling, access to peripherals, and provision of sight lines long enough for visual relief from extended focusing on the screen. The latter considerations make the placement of workstations so that the student directly faces a wall within 760 - 1000 mm (30-40 in) undesirable.

If a laboratory will be used for teaching involving extensive speaking, listening and note taking as well as VDT practice, provision must be made for users to have periodically a common orientation to the instructor. If a laboratory will be used for group discussion and practice, as in a group programming project, an orientation of group members toward the rest of the group must be provided.

Laboratory designs should be flexible to accommodate hardware advances over time.

An analysis of laboratory configuration is provided in Table 7. Sample laboratory layouts are shown in Figures 3-5.

With regard to laboratory size, it is suggested that an area in the range of 4.3 - 4.7m^2 (46 - 50 sq. ft.) per workstation be allocated with an additional 20-30m^2 (215 - 325 sq. ft.) of space provided adjacent to the main laboratory for secure storage, noisy peripherals and for maintenance use.

A functional evaluation checklist for assessing existing laboratories is provided in Table 8. (Branson)

TABLE 7

LABORATORY CONFIGURATION ANALYSIS

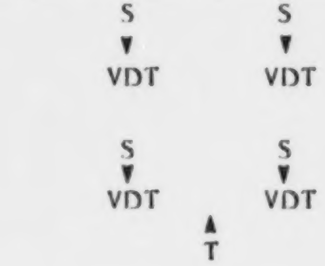
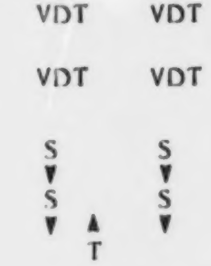
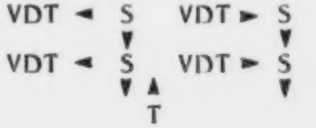
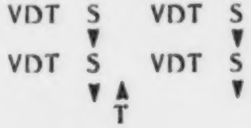
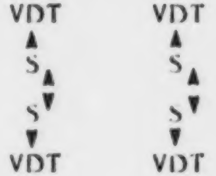
Student Grouping \ Teaching Style	Integrated Teaching/Practice Activities	Separated Teaching Activities	Separated Practice Activities
Ungrouped	Individual instruction and practice. No special workstation orientation required. Orientation to VDT required.	Individual instruction. No special workstation orientation required. Orientation to VDT not required.	Individual practice. No special workstation orientation required. Orientation to VDT required.
Grouped	Workstations must have common orientation toward the teacher. Orientation to VDT is also required.	Students must have a common orientation toward the teacher. Orientation to VDT not required.	Individual and/or group practice. Orientation toward other group members is required. Orientation to individual VDTs is required.
Composite Configurations (S - Student) (T - Teacher)			(Individual practice only) NO SPECIAL CONFIGURATION
			(Individual and group practice) 

FIGURE 3

COMPUTER LABORATORY WITH SEPARATE PRACTICE AND TEACHING AREAS

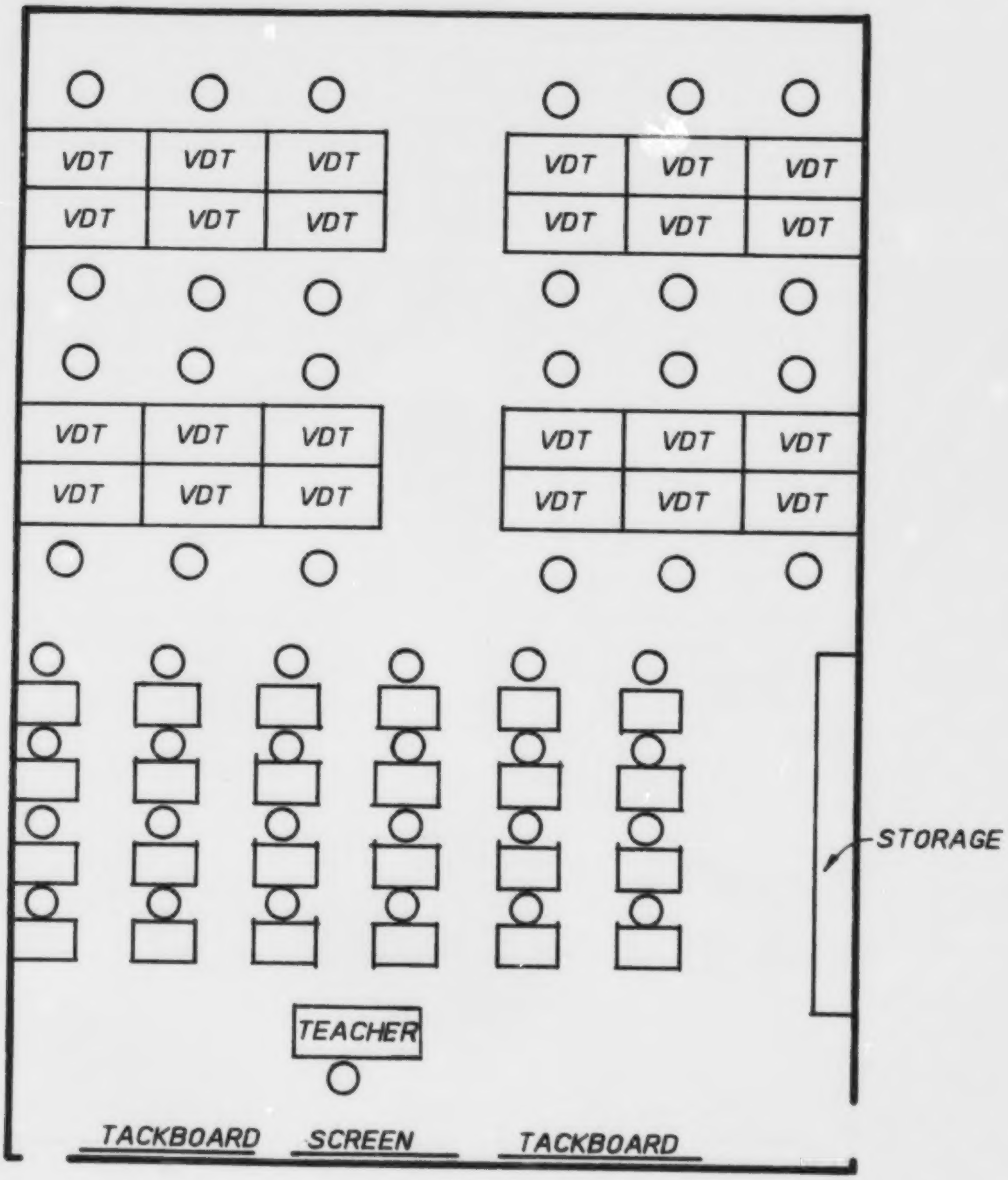

VDT
TEACHER
STORAGE
TACKBOARD
SCREEN
TACKBOARD

FIGURE 4

COMPUTER LABORATORY DESIGNED FOR GROUP WORK PROJECT

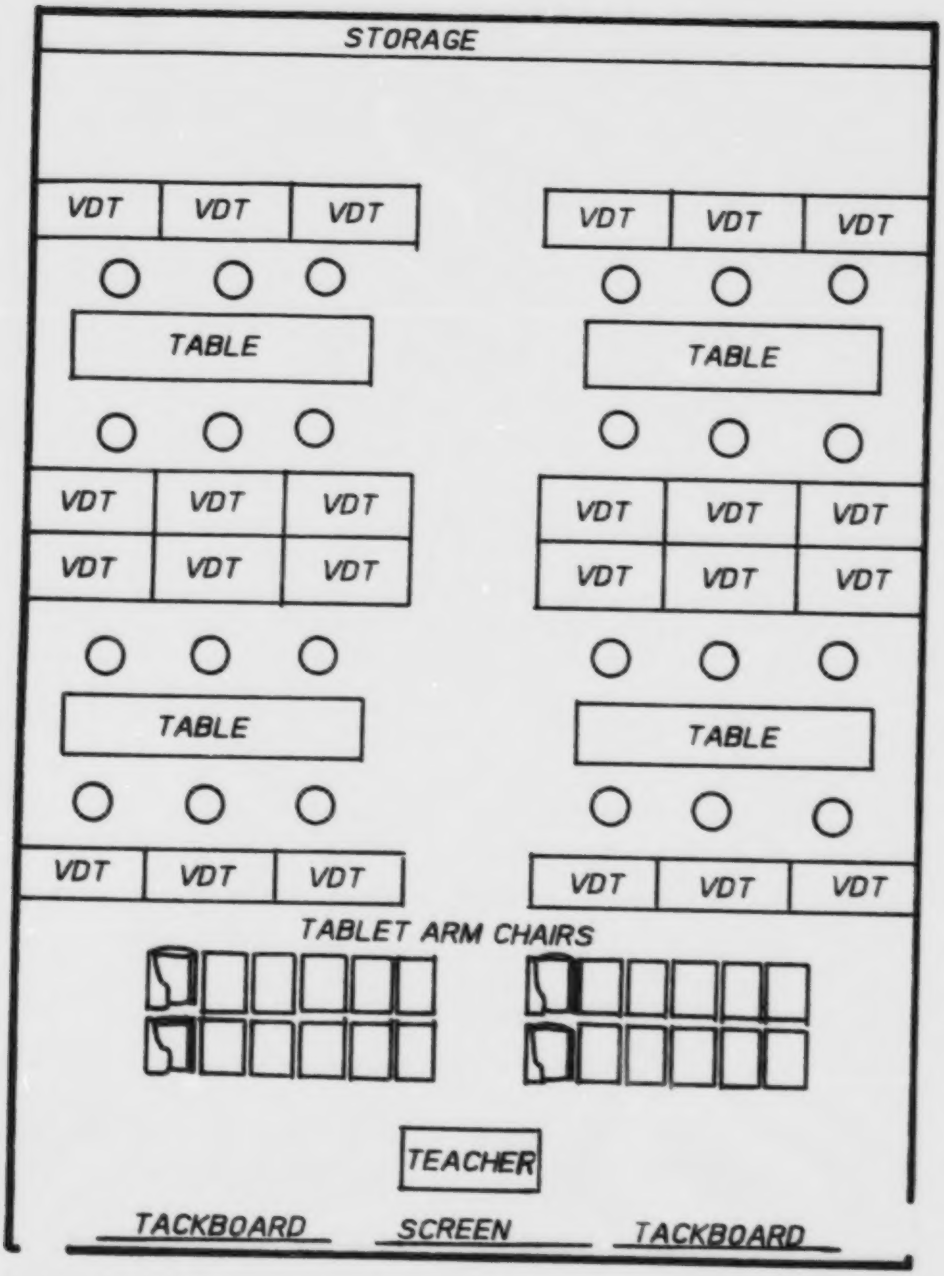

STORAGE
VDT VDT VDT
VDT VDT VDT
TABLE
TABLE
VDT VDT VDT
VDT VDT VDT
VDT VDT VDT
VDT VDT VDT
TABLE
TABLE
VDT VDT VDT
VDT VDT VDT
TABLET ARM CHAIRS
TEACHER
TACKBOARD
SCREEN
TACKBOARD

FIGURE 5

COMPUTER LABORATORY WITH INTEGRATED PRACTICE AND TEACHING AREAS

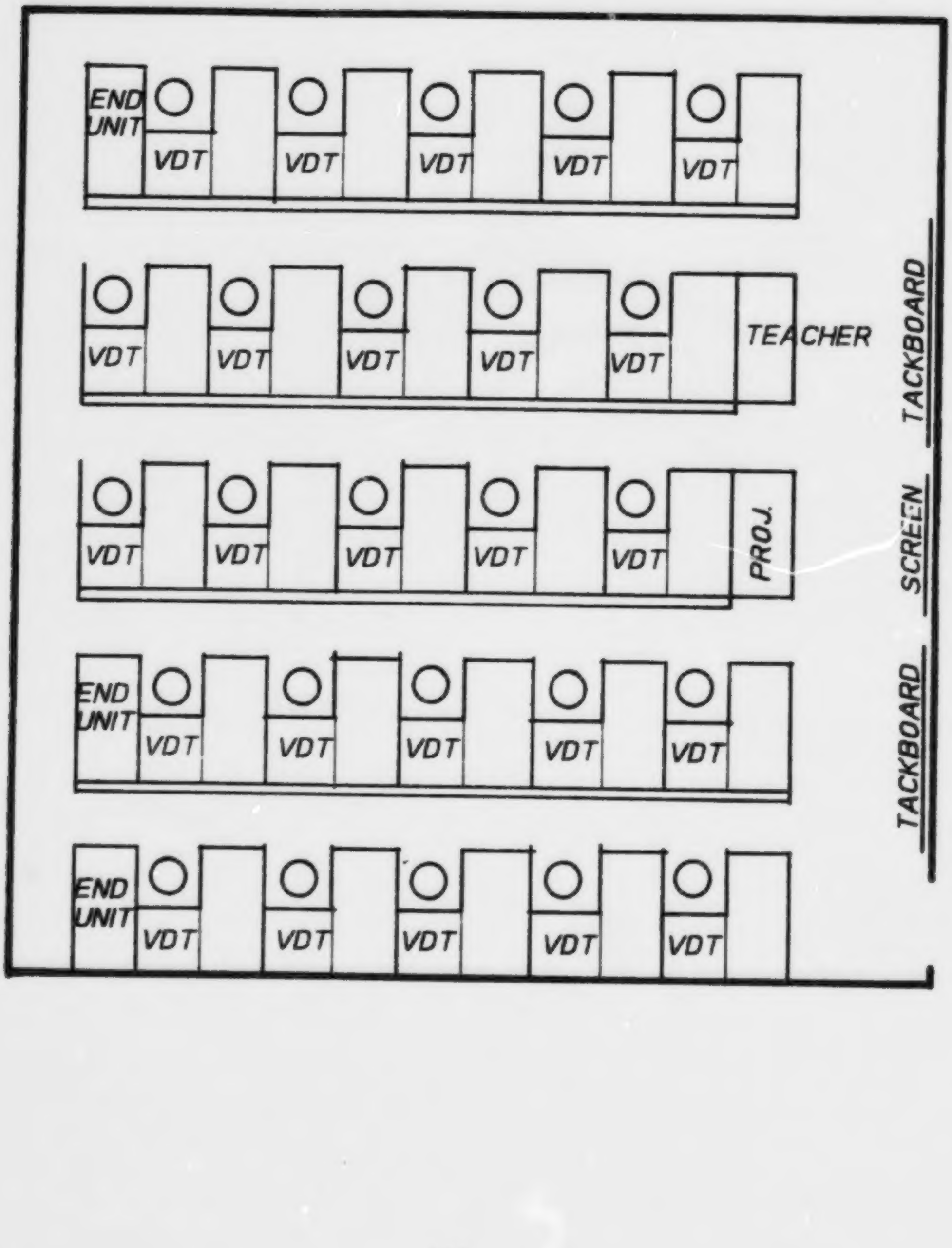

END UNIT
VDT
TEACHER
PROJ.
TACKBOARD
SCREEN
TACKBOARD

TABLE 8

BUSINESS EDUCATION LAB - FUNCTION EVALUATION CHECK LIST

School:______________________________ Room#:____________

Room Designation (Primary Lab Utilization):__________________________________

Date:__________________________________

Current Year's Utilizations:

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________

Functional Factors	Assessment (Acceptable/ Inadequate)	Comments/Action
Orientation: a. Location - proximity to other labs - service accessibility - circulation patterns - safety		
Security: a. Interior/Exterior b. Alarm System c. Door Security d. Machine Identification		
Room Basics: a. Room Size b. Room Shape c. Cabinets d. Shelving e. Boards (black, dustless) f. Tackboards g. Other/Alternatives		

TABLE 8
(Continued)

Functional Factors	Assessment (Acceptable/ Inadequate)	Comments/Action
Electrical Supply: a. Adequate Outlets b. Suitable Configuration c. Control Panel d. Circuit Capacity e. Filtering Needs Lighting: a. Adequate Levels b. Control Capability c. Blinds/Drapes d. Glare Control		
Acoustics: a. Noise Levels b. Noise Control Capability		
Heat, Ventilation, Humidity: a. Heat-adequate Control b. Ventilation-adequate Supply c. Humidity-adequate Levels		

Summary Statement:

(Branson 1985)

2. Architectural Design Criteria

a. Access

Security considerations suggest that access to the computer laboratory should be controlled. This is best achieved by locating the laboratory away from exterior building walls. Modifications will have to be made where the computer laboratory will be used outside of normal operating hours; for example, to serve adult education programs. Adequate wheelchair access should be provided.

b. Acoustics

Careful attention must be given to room acoustics because normal classroom noise levels will be supplemented by noise arising from computer printers, disc drives, audible cursor controls, voice synthesizers and by increased airflow from ventilation and air conditioning systems. Overall noise ratio should be about NR 45 - 50 (IBM 1984). Acoustic control should be addressed through ceiling, wall and floor finishes and acoustic insulation of air ducts.

c. Colour

Walls should have a matte finish in a neutral appealing colour. Pastel tones and a greater use of dusty colours and a palette of earth tones is suggested. Cohen in a recent article in "Computer Data" notes the effects of colours as follows: red - warm and stimulating, blue - cool, sedative and depressing, yellow - warm and capricious, green - pleasant and healthy, orange - stimulating, and purple - dignified and reserved. Murals might be considered to provide visual relief from periods of intense visual concentration on computer screens.

d. Dust Control

In order to reduce maintenance problems with computer disc drives, materials and room accessories should be selected which are readily cleaned and which do not contribute dust to the room environment. In particular, chalkboards should be replaced with overhead projection screens or whiteboards, although the latter are not entirely dust free. Windows should be sealed.

e. Natural Light

The use of natural light must be carefully planned to avoid both direct screen reflections and also ceiling glare. An overall light level in the range of 400 - 700 lux (37-65 foot-candles) is recommended (Yeaman). Natural light levels are in the range of 1 000 lux (storm cloud cover) to 100 000 lux (9290 foot candles) (unobscured sun) (IBM, 1984). Natural light, if any, must be attenuated and provided in a direction perpendicular to VDT screen orientation.

f. Security

Security provisions should include fire resistant walls which extend from true floors to true ceilings. Skylights and windows should be barred. Automatic fire doors should be considered to control smoke damage to computers as well as for fire-spread control. Storage for computer tapes and discs should be fire-, water-, and smoke-proof. (AFIPS). Remote or off-site storage of data backups should be provided. Equipment should be attached to furniture.

g. Static Electricity Control

Floor materials should be selected which resist static electricity build-up. Consideration should be given to providing a vapour seal envelope for the laboratory by using vapour barriers and sealant paints for the lab. (Holscher, 1984). Humidity control assists in reducing static build up. Triple glazing should be considered to reduce window fogging resulting from inside humidity conditions in cold weather.

h. Storage

Storage (some lockable) should be provided for computer supplies and student and teacher reference material.

3. Electrical Design Criteria

a. Cabling

Electrical raceways can be incorporated into student workstations. Raceways should be large enough to provide for cables for: regular power, clean power, telephone data lines, local area network communication lines. (Schneider). As an alternative, cable hangers can be provided inside workstations with wires being bundled using nylon ties. Raceways should connect to room systems by raceways located in floors, walls or ceilings. If freestanding poles are used to communicate to ceiling raceways they should be placed against walls or otherwise secured to withstand severe classroom usage which greatly exceeds that normally found in office environments. All raceways should be readily accessible to permit cable changes, extensions and repairs, but should not obstruct vision.

b. Communications

In addition to intercom communication, provision should be made for regular phone service through the school switchboard and for separate dial-up lines to computers with modems. The latter should by-pass school switchboards and have no extensions which could cause data line disconnection. Provision should be made for installation of a local area network.

c. Fire and Smoke Protection

Fire and smoke alarm systems should automatically close computer room doors and cut off all air supply to the computer room. The latter is particularly important because a fire in a remote part of the building can still cause severe damage to computers from circulated smoke. Only halogen-type fire extinguishers should be provided in computer labs. Use of sprinkler systems should be avoided. Computers and peripherals should be provided with plastic covers which can be pulled on when computers are not in use. Such covers have proven useful in reducing damage from fire, smoke, water and ambient dust. Fire resistant construction should be utilized when feasible.

d. Lighting

Artificial lighting for the computer laboratory should be in the range of 400 - 700 lux (37 - 65 foot candles) (Yeaman). Light distribution should be as uniform as possible throughout the room. Indirect lighting (Dietsch) should be considered. If fluorescent lighting is used, full spectrum lamps should be considered as a contribution to reduction of eyestrain. Egg crate and prismatic diffusers on fluorescents are inadequate; parabolic diffusers which greatly reduce ceiling glare should be used.

e. Power Supply

In order to reduce computer maintenance cost as well as to protect against data loss and downtime, computers should be provided with clean power. Cook and Holscher recommend that a recording power line monitor be installed for several weeks to determine the nature of power supply problems at the laboratory location. Subsequently, appropriate equipment should be installed either, on a room or on a computer basis, to control spikes, surges, noise (electromagnetic and radio-frequency). An uninterruptible power supply (UPS) should be considered for key computers where data loss through power interruption would cause significant recovery costs. As a minimum, computer power supply and isolated grounding should be provided directly from a main power panel. Master switching for computers should be provided in each laboratory with key controls to prevent accidental or malicious shutdowns. This provision is needed for the teacher to control learning-teaching activities. Individual workstation switching should also be provided. The installation of equipment with strong magnetic fields in adjacent rooms should be avoided.

f. Security Systems

In addition to fire and smoke protection systems, consideration should be given to provision of intrusion alarms.

4. Mechanical Design Criteria

a. Comfort Conditions

Normal comfort conditions are sufficient for trouble-free micro-computer functioning. It is suggested (Cohen & Cohen) that temperatures be maintained in the 20 - 22°C range and humidity in the 40 - 60% range. In the Alberta winter setting, a range of 20 - 30% is more practical. The maintenance of these ranges may require special treatment. Goldstein notes that a typical computer terminal gives off as much heat as a person. It may well be that the additional heat load in a computer laboratory will require the provision of cooling at certain times of the year. Goswami suggests the provision of cooling by way of a package unit supplemented by an in-room humidifier to maintain adequate humidity for dust and static electricity control. Miller notes that adequate ventilation assists with ion depletion problems associated with VDTs.

b. Acoustics

Because of the anticipated higher noise levels in computer laboratories, consideration should be given to minimizing the noise of airflow to the computer lab.

c. Dust Control

Adequate humidification will contribute to air particle control. However, consideration should be given to other control measures such as recirculation of laboratory air combined with supplemental filtration. (Cohen & Cohen).

d. Fire and Smoke Control

It is important that HVAC systems be controlled through the heat and smoke detector system to cut off air circulation to the computer lab. Halogen fire extinguishers should be provided in the lab. Sprinkler systems should be avoided.

e. Utilities

It is suggested that a sink be provided in a laboratory back-up room as a general aid to maintaining cleanliness and for hand washing after printer ribbon changes.

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SOFTWARE/COURSEWARE EVALUATION, DEVELOPMENT AND ACQUISITION

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Wighton C. A. I. Services Ltd.

A. SOFTWARE/COURSEWARE EVALUATION

I. The Software/Courseware Publishing Industry

a. Background

1. The software/courseware publishing industry has been characterized by rapid growth since the introduction of the microcomputer. For example, the number of courseware publishers for Apple products has increased from approximately 200 in 1983 to over 1,000 in 1985. The number of products has shown a corresponding increase. It is estimated that there were 1,000 courseware products in Apple format available in 1983; that figure is now between 5,000 and 8,000.

2. With rapid growth has come intense competition. This was evident first in the software sector where the potential profits are largest but consequences throughout the market are now being felt. These are:

   - Companies find it difficult to rely on a successful product for very long;
   - New and better products have to be released quickly, often before they are ready;
   - Frequent revisions are often necessary;
   - Most products have short shelf lives;
   - cost/quality ratios are changing - current products may not be cheaper but the quality is much better;
   - There is an increased failure rate of companies;
   - There is an increased acquisition rate of smaller companies by larger companies.

3. With the large numbers of companies and products, the need to acquire market visibility quickly has become critical. Some software companies have embarked on massive advertising campaigns; however, this is impossible for most of the courseware producers who, by and large, have been small "mom and pop" companies with limited expertise in marketing. The difficulties in marketing products to schools have resulted in a number of consequences:

   - Companies who had relied on traditional means of marketing school products (i.e. mailing catalogues) have either removed themselves from the market or have had to adopt new techniques to survive;
   - Price discounts for even a small number of purchases are available;
   - Small companies are no longer attempting to market their products but are selling them to larger companies which have the necessary expertise and resources;
   - Successful companies have tended to specialize so that they can get visibility in a particular subject area. Companies which provide large catalogs covering a wide number of subject areas are generally poor risks;
   - Large publishing houses which had not gained entry to the

courseware market have now done so by placing less emphasis on in-house development and more emphasis on acquiring independently developed products; however, after some initial failures, some reluctance to remain involved has been evidenced.

4. Major educational publishing houses are becoming gradually involved in the courseware field. They have the advantage of having sufficient resources to develop a product properly and they have the marketing expertise needed to sell it. Most of these companies see limited profits in selling single, isolated textbook packages, where they are intended to serve a supplementary role; in other cases, they are so poor that they perform no useful purpose and are used primarily as 'technological lip service.' Other educational publishers have taken products from other courseware developers and have dressed them up for the classroom (e.g. Scholastic with "Bank Street Writer" and Addison Wesley with products from The Learning Company).

5. Piracy has been a severe problem for both software and courseware publishers. This is particularly the case in the educational area where profit margins are small to begin with. This has been compounded by the limited resources available for legitimate purchase and the need to acquire class sets of products.

b. Projections for the Immediate Future

The trends identified above will continue. Some of the more important consequences will be:

1. The rapid growth in companies and products will likely level off. More small companies will disappear either through absorption or failure and it will become increasingly difficult for small starting companies to make a successful beginning.

2. Educational technology will continue to have high visibility and desirability in the North American public eye for the short term. Resources will continue to be made available in the United States and Canada but it is unlikely that substantially increased funds will be allocated. Some recognition of the need for equal sharing of these funds between hardware and software will be made but hardware will initially continue to get the lion's share. As a result, competition for limited software dollars will continue to be high and piracy will likely continue unabated. In the longer term, a higher share of the resources may be made available for software acquisition but this increase will face an increasing public backlash against wastage of resources on a technology which does not appear to be solving all of education's problems.

3. The need for marketing expertise and the necessity of waiting longer periods for investments to be realized will become more pronounced. Larger publishing houses will play a more important role in acquiring

products from developers. As a hedge against piracy, as a way of relying on their established expertise and in order to maintain profits, publishers will tie courseware products to textbooks.

4. Courseware products which have low potential for profits will not be developed without government initiative and support. In Canada, this would likely mean that materials in Social Studies, non-core subjects such as Industrial Education, Home Economics, etc., Special Education and all French materials will be very difficult to find.

c. Roles of Alberta Education and the School Jurisdictions

1. It is unlikely that the Alberta market has sufficient importance that anything that would be done here would have an impact on the directions that the software/courseware industry appears to be taking. In recognition that products in certain areas will be unlikely to be developed by the industry, provincial initiatives and cooperative ventures in developing courseware products should be investigated.

2. In Alberta, the projection of poor sharing of funds between hardware and software can be reversed with due attention by provincial and school officials. More priority has to be placed on assisting school districts in acquiring software and school districts have to address the same problem within their budgets. This issue will be discussed later.

3. The projected backlash against further expenditures can be delayed, if not reversed, by due attention to all of the issues raised in this Symposium. Without the establishment of comprehensive planning, appropriate allocation of resources, education of all stakeholder groups, etc., a backlash will be inevitable.

II. The Evaluation Industry

a. Background

1. The first widely recognized courseware evaluation agency in North America was Microsift, which began operations circa 1981. Microsift developed a check list document and made this, and evaluator training, available to organizations interested in becoming part of their network.

2. In July 1982, Alberta Education began a summer pilot based on the Microsift training and instrument. Subsequently, a different instrument was developed and full scale operations began in January 1983.

3. At about the same period, the EPIE institute was beginning to expand its evaluation of textbooks into the courseware field. They too developed in instrument and began operations around 1983.

4. In the subsequent years, other provinces and states began to involve themselves in evaluation. Some chose the Microsift model and became part of that network through which evaluations were collected by Microsift and made available on the RICE database. EPIE expanded its operations and sold its services to participating districts on a subscription basis. A database of available products was established and made available both electronically and through a print catalog (TESS). Through the Council of Ministers of Education of Canada, Alberta Education was influential in having planning initiated for a Canadian database of courseware evaluations. Evaluation criteria based on the Alberta instrument were adopted by all ten provinces and agreements on the necessary components in an evaluation program were also reached.

5. While these three organizations have proven to be the leaders in the evaluation industry, other evaluation organizations have operated independently. Computer magazines and journals continue to devote a small portion of their space to evaluations which are generally written by a single contributor. One publication was devoted solely to evaluations but it was discontinued after a year of operation. Some individual school districts have set up evaluation programs (e.g. New York City) and some computer user groups also have conducted courseware assessments. The NEA set up an evaluation program but its credibility has been damaged by policies which are at odds with the rest of the industry (charges for evaluation) and by conflict of interest accusations.

6. As the number of courseware products continued to grow, there was growing realization that no one agency could keep up with the demand or the supply. As a result, there has been growing interest in the establishment of consortia of evaluation agencies. California provided the lead in 1983 in producing a "preview guide" based on the evaluations of approximately 20 agencies. That consortia has now increased to 29 members and has produced an annual report that many states use as their main evaluation effort. Also, as mentioned earlier, Canadian provinces have established a sharing arrangement which will result in all Canadian results being accessible to Canadian schools in 1986. In addition, a consortium of 7 southeastern states will be testing a sharing model in 1986.

7. In late 1985, Microsift announced that its five year term of funding had ended and that it would be discontinuing its current program of evaluation. There was some indication that specific evaluation projects would still be undertaken but they would not continue to conduct general courseware evaluations.

8. Most evaluation agencies conduct approximately 100 - 200 assessments annually.

b. Projections for the Immediate Future

1. With the continued growth in the number of available products as well as in the numbers of schools requiring evaluational information, there will be increased need for valid evaluations. As the costs for these are high and as there is too much for any one agency to do on its own, the trend in forming consortia will grow.

2. As education officials in states and provinces become more knowledgeable about courseware and its evaluation, it is possible that a consensus of opinion on the major factors in determining the worth of a product will be reached. These consortia will then serve as major communication vehicles in transmitting the expectations of educators to developers and in relaying information to educators about available products. Producers will be assisted as they will not only be getting a clearer message on expectations but they will be able to get information to the field without having to service every school district in the state/province. There is the corresponding risk for producers that the increased role of the consortia will place a higher emphasis on the results of one or two evaluations.

3. Unfortunately, at this point in time, it is equally likely that as education officials in states and provinces become more knowledgeable about courseware and its evaluation, they will form differing opinions on what constitutes good and bad courseware. This, plus the necessity of attempting to address the different needs of each member of the consortia, may result in consortia members only being able to reach general and superficial agreements. This is particularly likely in the United States where there is little agreement among the states as well as within the states as to the role (if any) that departments of education should play in evaluating resources on behalf of school districts. The probability of reaching agreement on specifics when agreement can not be reached on the overall goal appears slim. What will likely result will be efforts that attempt to serve all needs and all expectations and end up serving none. There is more likelihood of success in Canada where agreement has already been reached on the overall role of the provinces in authorizing learning resources as well as on the specific courseware evaluation criteria. Canadian success however will depend more on the availability of the resources necessary for each province to carry its share of the load. At this

point in time, it would appear that most provinces will be conducting a very minimal program of evaluation in the immediate future.

4. As consortia are by nature cooperative, all will suffer problems resulting from the lack of centralized control. Maintaining standards and agreements in terms of quantity, quality, reporting procedures, establishment of priorities, etc. is very difficult to do under the best of circumstances. As each member is independent, any value the consortia will have will be dependent upon a continuing agreement on the principles involved, equitable allocation of resources, continued priorization of technology within the members' other objectives, etc. Under these pressures, consistent quality evaluations may be difficult to acquire.

5. Within Alberta, there will be serious questioning of the feasibility of Alberta Education continuing to provide the bulk of the evaluations for the other provinces. This likelihood will be considerably increased in the next two years if other provinces do not begin to contribute to the national database or if their contributions do not have the necessary quality.

c. Roles of Alberta Education and the School Jurisdictions

1. It is important in the next two years that Alberta Education continue to emphasize the development of sharing arrangements and contribute to these positively and actively. Major success has been achieved in establishing a Canadian agreement and some success has been reached in influencing the program of other organizations in a positive manner. Emphasis has to be placed on promoting an increase in the evaluational standards of other agencies, on reaching an industry consensus on the major evaluational criteria and on finding more effective means of conveying expectations and needs to the publishing industry.

III. Requirements for a Successful Evaluation Program

a. Background

As the evaluation industry has developed, it has become increasingly apparent that, to be successful, the evaluation program must contain the following ingredients:

1. Evaluations must be based on the assessments of more than one person and those persons must be educators with subject area or grade level expertise in the content under review.

While it would likely be generally conceded that a person evaluating a certain product should be an experienced educator in that subject area or grade level, it is not general practice for a review to be based on evaluations from more than one person. Perhaps due to the economics involved, many evaluation agencies still base their reviews on one assessment. However, there is growing acceptance that evaluations have to be conducted by more than one person in order to avoid the personal biases that are bound to occur and to ensure that all the strengths and weaknesses are identified.

A few agencies go to the other extreme and involve a wide number of people. With a large number of people, results get obscured by the variety and amount of opinion.

There is a growing acceptance of the need to pay evaluators for their work. This has always been the case for agencies using anecdotal reports but agencies using check list instruments by and large have relied on unpaid volunteers. While the desirability is accepted, this has not necessarily been translated into practice.

It would appear that reports from three evaluators are optimal. Note however, that the ingredients for a successful evaluation program are interdependent; the number of evaluators is closely related to the type of instrument used and the need for evaluator training. Using more than one evaluator by itself will not provide success.

2. To provide the necessary depth of assessment, evaluation programs should be based on an anecdotal instrument.

Almost all agencies use a simple check list instrument to conduct their evaluations. While this has the advantage of ease of completion, the instrument does not require the kind of intensity that will produce a comprehensive and valid evaluation. Check list documents can not provide more than a brief assessment of the product and, as such, are useful only as a gross screen. They also have significant weaknesses in their effectiveness in reporting findings on the evaluation. Reading a report which consists largely of checkmarks against columns of vague headings and statements is usually meaningful only to the person who conducted the evaluation. Descriptions of the program and the reasons behind the assessment results are not provided and, as such, the reader learns little about the program other than the final recommendation.

Check list documents have another weakness as they are inadequate for any product which varies slightly from the norm. The advantage of this kind of instrument is its speed of completion - a limited number of questions is posed, each focusing on a very specific item and generally requiring a black or white answer. The questions however may not always be appropriate for a particular program and answers may not always be black or white. In such circumstances, results from check list instruments can be misleading as well as invalid as there is no opportunity to expand the document by either adding other required questions or explaining the responses. In effect, the advantage of ease of entering concise comments is negated by the likelihood that such brevity can be misinterpreted.

While check list assessments require the programs under evaluation to fit within the structure of the instrument, anecdotal formats on the other hand are flexible enough so that the instrument can fit the product. The disadvantage of anecdotal reports is that, by their nature, they are time consuming to complete and they require the use of trained evaluators. Only two agencies (Alberta and EPIE) complete assessments that are based primarily on anecdotal reports. It is no coincidence that both of these agencies also have the lowest "acceptance" rates and the highest credibility in the evaluation field.

3. Equally as important as the format of the instrument, are the criteria that the instrument investigates. Both the check list instrument's value as a screen and the anecdotal instrument's value as an in-depth assessment will be negated if the right questions are not asked or if the questions are not given appropriate weighing.

   Many of the instruments used by agencies focus unduly on non-pedagogical criteria. In part, this is done for ease of use - questions on technical quality, memory requirements, length of documentations, etc. can be more easily answered than questions on pedagogical development. In part however, pedagogical criteria are simply overlooked. It appears incongruous that an educational resource should not be asssessed first and foremost with educational criteria, but that has often been the case.

4. A fourth critical ingredient is the training of the evaluational staff. This is required to ensure proper use of the instrument and to assist evaluators in applying the same level of expectations.

   It is generally conceded that the use of an anecdotal report requires evaluational staff to be trained in its use; the same agreement is not reached with check list documents. Although some agencies do provide minimal training, many simply send out products and a check list to whomever wishes to see the program. It is perceived that as the check list instrument only requires a user to answer the questions, any classroom teacher can provide the necessary reviews.

This thinking is fallacious. Check list instruments, through their reliance on conciseness, depend heavily on proper completion. As there is little room for error, a misintepretation of a question or a mistake in judgement can be extremely costly in terms of the overall results. Teachers can not be expected to complete an assessment instrument as required professional standards without training.

The newness of the media is a second very important reason to train evaluators as few teachers have had the opportunity to become proficient in the use of courseware products. With print materials, teachers add their experience as a teacher to a minimum of 16 years of experience as a user; they are not only familiar with what kinds of capabilities the product has but have a wide range of experience in using both good and bad products. That experience is almost completely lacking with courseware products. It is not surprising therefore that training of courseware analysts is needed not only to supplement their previous experience in applying appropriate expectations but also to expose them to examples of good and bad.

A study out of the United Kingdom on the training of teachers to select software contained some interesting observations.

"Few courses for teachers successfully tackle the problem of training inexperienced teachers to develop the skill necessary to distinguish good educational packages from bad. Most courses do include sessions where teachers can browse through some of the available software but they lack an appropriate framework which would provide the teachers with the skills and experience necessary to judge the software critically." *

"The problem with most checklists is that a reasonable amount of background knowledge and experience is needed to make the best use of them." **

"The lists themselves do not provide this knowledge - but they assume the experience. Most in-service training courseware are too short or the trainers fail to recognize that developing criteria for selecting good software is not easy and so do not provide the background which teachers need in order to benefit from checklist activities. ***

"Our study shows that discriminating between good and bad features of software design is not a trivial task. Many people with this skill have acquired it almost unknowingly over a period of time and consequently greatly underestimate the difficulty of helping others to develop similar skills. Having analyzed how the teachers performed on our activity, we argue that it is essential to provide them with a sound basis from which to make judgements. Merely showing them several software packages and then leaving them to work through others for a few hours, as is practiced in many in-service training courses, is not sufficient. Similarly, providing checklists on their own is also inadequate as it takes time and experience to use these lists well. ****

* Jenny Preece and Ann Jones, "Training Teachers to Select Computer Software: Results of a Formative Evaluation of an Open University Pack", British Journal of Educational Psychology, No. 1 Volume 16, (January 1985): p.10.

** Ibid., p.11

*** Ibid., p.11

**** Ibid., p.19

5. As students are often more at ease with the new technology than teachers, another ingredient for a successful evaluation program is the incorporation of observations of student users as part of the evaluation process. The impressions of the evaluator on the program's ease of use, its motivational capabilities, etc. may be based on his/her familiarity with the technology and may thus be inaccurate assessments of its impact on students. It should be noted that an evaluation program is at best a prediction of the value of a product in the classroom. As such, using the product with students adds a measure of validity to this prediction.

b. Projections for the Immediate Future

The following comments are projections for North America in general:

1. The use of more than one person to complete an evaluation will become accepted practice. However, those agencies which use check list instruments and/or untrained teachers, will rely upon the opinions of many to "ensure validity." Reports from these agencies will generally not provide sufficient information to be worthwhile and findings will in most circumstances be overly generous.

2. The check list instrument will continue to be used by most agencies and, as a result, their findings will be appropriate only as an initial screen.

3. There will be a slight trend towards including more educational criteria within assessment instruments and giving them higher priority. As consensus is formed on the educational ingredients which make good courseware, the present practice of rating products primarily on technical aspects will become less common. However, with these changes in emphases, there will be an increased need for trained evaluators who understand the criteria and use them properly.

4. There will be growing acceptance of the need for agencies to train their evaluators; however, limited resources will likely inhibit any substantive changes.

5. There will not likely be any substantial changes in the near future in the content of general teacher inservice or preservice. First, recognition that such evaluation training is necessary will be slow and gradual. Then, consensus on the optimal means by which such training can be delivered and the content of the inservices will be difficult to achieve. As there are few experts in courseware evaluation and as acquisition of such expertise through normal classroom use is at best a slow process, it is unlikely that much impact will be made on the bulk of the teaching force.

6. Observations of student users will be more commonly incorporated within the evaluational process.

c. Roles of Alberta Education and the School Jurisdictions

1. The pessimistic projections in the foregoing section do not necessarily apply to Alberta for the following reasons:

   - Alberta has an active and valid evaluation program already in place;
   - A substantial number of teacher evaluators have already been trained and this program will continue;
   - Selection criteria to the evaluation team have taken into account the desirability of spreading evaluators throughout the province;
   - Post-secondary institutions have included components on courseware evaluation within their programs;
   - School districts are beginning to set up their own evaluation programs and are basing criteria and training on the Alberta Education model.

2. Alberta Education should continue to play an active role in providing leadership and assistance in helping jurisdictions set up appropriate inservice and evaluation programs.

3. School districts should ensure that the evaluation programs that they establish are based on ingredients identified above. They should also ensure that resources are not wasted through duplication of efforts.

4. Improved communication vehicles between Alberta Education and school jurisdictions should be established so that evaluation results from all parties can be shared effectively (see discussion later in this report).

IV. Overall Quality of Evaluation Agencies/Quality of Evaluations

a. Background

1. As has been indicated earlier, most evaluation agencies do not contain all the ingredients that are perceived as necessary to produce a successful program. Most are based on a check list instrument, many use untrained teachers and some use only one teacher per product. Evaluations from journals are too scarce to be of much use and are generally based on the opinions of only one reviewer. While the results from most of these agencies could not be considered as valid evaluations, they could however be used as part of an initial screening process. For actual evaluations of a product, only EPIE and Alberta Education reports would provide the necessary validity and detail.

2. Most evaluation agencies approve between 60%-70% of the materials they review; however, a number of agencies in the United States have approved 100% of the products that they have evaluated in an operational year. Both EPIE and Alberta Education have approval rates in the 20%-25% range.

3. Most evaluation agencies only reject between 5%-10% of the materials they review. This follows only partially as a consequence of the high acceptance rates. Even those which have moderate acceptances (e.g. 60%) have very low rejection rates. Instead, products are classified as 'borderline'. Alberta is the only agency which rejects more than 50% of the products that are reviewed.

4. With the growing trend toward consortia, consortia reports are now becoming available. As these reports are based on the contributions of a number of agencies, the material can be valuable in terms of the number of different products listed. For example, the California Consortia report was based on over 4,000 evaluations. However, quality standards tend to be based on the average contributing agency and thus are generally low. These reports however can serve as valuable screening devices. Any product that has been shown as recommended in such guides will have been favourably reviewed by a number of agencies. The chances of finding good products is thus improved.

5. Alberta Education has been instrumental in raising the awareness of the generous standards of most agencies at consortia meetings. During 1986 there was a significant decrease of 8% in average acceptance rates in the California Consortium and this can be attributed at least in part to Alberta's participation.

b. Projections for the Immediate Future

1. As the quality of evaluation agencies and their reports is directly related to the existence of the necessary ingredients outlined earlier, the projections for any positive changes are the same as earlier - i.e. pessimistic. It is unlikely that reports from other agencies will be useful for anything more than a gross screen. It could be reasonably assumed (in view of their very low rejection rates) that anything rejected by an outside agency is not worth considering; however, products that are approved are not necessarily good. For United States based agencies, EPIE would be the one exception to this observation.

2. With the trend towards consortia, the value of these reports will continue to increase, if only due to the range of products that are covered. If Alberta Education and EPIE institute continue to play a pro-active role, the trend towards tighter standards may continue.

3. If the other Canadian provinces allocate the necessary resources and begin to implement evaluation programs according to the national agreement, the national database could become a significant asset. For the immediate future, its value to Alberta will likely be minimal.

c. Roles of Alberta Education and the School Jurisdictions

Alberta Education should continue to play an active role in all of its national and international agreements. Attention should be paid to adopting a strong pro-active stance to solving the identified problems.

V. Alberta's Evaluation Program

a. Background

1. Alberta's evaluation program, administered through the Clearinghouse, has been in full-scale operation since January 1983 and contains the five necessary ingredients identified earlier. The process consists of three stages - screening, evaluation and authorization. Screening is conducted by two trained evaluators using a check list document - in three years 68.5% of the products formally evaluated have been rejected in this stage. A full-scale evaluation is completed in the second stage by three trained teacher evaluators (generally different people from those used to screen) using an anecdotal instrumental - in three years 17.1% of the products formally evaluated have been rejected in this stage. The authorization process consists of a curriculum fit, a "Tolerance and Understanding" check and the actual authorization of the product. This stage involves teachers and government officials in conducting the necessary analyses and reaching a decision - in three years 2.5% of the products formally evaluated have been rejected in this stage. Of the balance (11.8% of the total), a supplementary status has been awarded in 78.4% of the authorizations and a recommended status in 20.9%. Only one product reviewed in three years has been given a basic status.

2. Over the three years, the Clearinghouse processed over 3,300 products. Of these, approximately 1,150 were formally evaluated. The balance was found to be unacceptable for reasons of unavailability, unsuitability to our curriculum or through reports from other agencies.

3. In the last year, the Clearinghouse has operated with three professional staff and three support staff. A cadre of approximately 150 teacher evaluators is used for first and second stage evaluations.

4. In comparison with programs from other agencies, Alberta's evaluation program has been recognized as one of the most effective and efficient. Alberta reports have high credibility and, at an average of 400 full-scale evaluations completed yearly, has one of the highest production rates in the industry.

5. Two weaknesses in the program's structure can be identified. First, the Clearinghouse has been unable to keep up with the demand from the field for information, particularly since BQRP funding was made available. This is partly a result of not being ale to rely too heavily on outside sources, but the main cause of the problem is based on the limitation of resources. Although Alberta's program has been generously funded, this has proven to be insufficient to meet the growing demands.

   The second problem has been the slowness that has been evident in actually authorizing products. Although evaluation reports are completed reasonably quickly, the final evaluation stage has proven to be extremely time consuming. This is currently being addressed through changes in administrative structure and priorities.

   Other weaknesses in distributing results and acquiring products for Alberta schools will be discussed later.

b. Projection for the Immediate Future

1. With quality of courseware products gradually improving, the percentage as well as the number of products authorized by Alberta Education will gradually increase. However, as most courseware packages provide limited content coverage, the majority of authorized products will remain at the supplementary level (assuming a continuation of the present definitions).

2. Alberta Education has provided generous funding for the evaluation program in the past. With increased demands, this funding level will likely remain at the present rate or may even increase. Any increases in funding will likely be tied to increased coverage, e.g. additional hardware support, assessment of software packages in addition to courseware.

3. Alberta Education will continue to provide an effective and highly credible evaluation program. Progress will be made in attempting to meet the demand from the field and authorization decisions will be made more efficiently. Full success in providing the necessary levels of service however will be affected by insufficient funds and will not be possible until suitable assistance from other agencies outside of Alberta is received.

c. Roles of Alberta Education and the School Jurisdictions

1. The success of Alberta's evaluation program is tied to the continuation of reasonable resources. Within Alberta Education, efforts should be made to maintain adequate funding and to limit expansion of the mandate to a manageable amount. Funding for personnel positions is,. at present, the most critical.

2. Improved communications between Alberta Education and school jurisdictions about the present state of educational technology in the schools and their projected needs will assist the Clearinghouse in meeting those needs.

VI. Distribution of Evaluation Results in Alberta

a. Background

1. In the first years of operation, Clearinghouse reports were distributed to all school superintendents and school jurisdictions in Alberta free of charge. In addition, copies were provided to key district personnel and to school librarians. Due to the rising distribution costs, this coverage has been reduced to one free copy for superintendents and one free copy for each school (as per normal Alberta Education policy). Additional copies may be purchased for a nominal charge of $10.00. Clearinghouse reports are issued once a year; present plans are to issue the report each spring.

2. To date, all Clearinghouse reports have been cumulative and have included full reports on authorized products (updated as necessary) and lists of products that were found to be unsuitable.

3. In addition to circulating information through the annual report, Clearinghouse staff provide "viewing rooms" at ATA regional conventions and at the ATACC convention. As all regional conventions are held within a four or five week period, it has not been possible to attend each convention each year.

4. To date, due to the slow speed of authorizations, limited use has been made of newsletters and circulars.

5. Clearinghouse staff members have participated in some professional day activities; due to resource limitations, this has not been widespread.

6. A viewing room has been maintained in the Clearinghouse office. Due to its accessibility to Edmonton area teachers during working hours only, this service has not been fully utilized.

7. While information is being made available on a regular basis, there are a number of problems with the service:

   - Information is provided only once a year; it would be desirable to increase the frequency;
   - Within jurisdictions, Clearinghouse reports are not always circulated effectively;
   - There is no ready vehicle for access to current information. This will become more important as jurisdictions embark on their own evaluation programs;
   - The costs of distributing a cumulative report are becoming prohibitive;

- Clearinghouse reports, through their textual presentation, can provide only limited assistance to jurisdictions in reaching their purchase decisions. The product should be seen before it is purchased and the program of viewing rooms can not begin to provide that service. Other alternatives have to be found.

b. Projections for the Immediate Future

1. Serious consideration will be given to changing the Clearinghouse's annual, cumulative report format. A series of current information packages is one of the possible options. This will likely require jurisdictions to assume responsibility for maintaining the cumulative and current nature of the report. No matter what the format, jurisdictions will face increased problems in centralizing the information and making it available to their staff.

2. Jurisdictions will begin to play a more active role in acquiring preview copies of recommended products and maintaining a centralized library. In spite of increased efforts from Alberta Education and from the jurisdictions in improving this service, problems in not being able to preview the products will continue to be an inhibiting factor in these services.

c. Roles of Alberta Education and the School Jurisdictions

1. Alberta Education should improve the effectiveness of its written reports through revising the format of the Clearinghouse report.

2. Alberta Education should begin planning for the implementation of an on-line messaging system so that questions on specific products and companies can be answered. In addition, through networking to all jurisdictions, bulletins and newsletters can be easily distributed.

3. Jurisdictions should plan for the effective storage, maintenance and distribution of Clearinghouse information and updates.

4. Jurisdictions should investigate the feasibility of maintaining their own viewing libraries; cooperative ventures between neighboring small districts should also be investigated.

5. A concerted effort by Alberta Education and school jurisdictions should be made to combat unauthorized copying.

B. SOFTWARE/COURSEWARE DEVELOPMENT

I. The Software/Courseware Development Industry

a. Background

1. The software/courseware development industry has been characterized by rapid growth and by a profusion of small developmental companies. As competition has increased, and as the sheer numbers of companies and products have become overwhelming, the smaller unsuccessful companies have begun to disappear. The software industry is the most competitive and is susceptible to the most rapid change.

   The courseware development industry is following somewhat the same pattern but at a slower pace. There have been a large number of companies which have developed educational materials; however, small, unsuccessful ones have found it increasingly difficult to penetrate the market and many are forging ties with larger companies. Some have licensed other companies to market the product and now focus only on development. The role of the established textbook publisher is now becoming more pronounced. As they have the resources to develop a product properly and as they do not have to have an immediate return on their investment, some have been able to produce quality products. This pattern is not consistent as many large companies have produced poor materials (or have purchased poor materials) and have been badly burned. While the trend has not yet become pronounced, it would appear that the industry is stabilizing a little and most of the new successful products will either be developed by companies who were able to make a name in the 'easy' years or will come from large publishing houses.

2. Production quantity for Apple materials is in the neighborhood of 1,000 - 2,000 new products annually. Commodore, Radio Shack and IBM figures are considerably less, with Radio Shack in danger of losing its market share to IBM.

3. Production quality has been generally poor, by Alberta standards at least. In the past this has been due to the hastiness with which the product has been prepared, the lack of involvement of educators in the design, and the insufficient utilization of the potential strengths of the computer. Much of the material prepared prior to 1985 could be characterized as 'electronic workbooks'. Quality is gradually improving. Design teams are now more commonplace and publishing houses, with their reputations to protect and through their established practice of field testing, are able to commit more resources and time to the developmental phase. Top quality products are still very difficult to find however. Where growth has been evidenced is at the bottom of the market - the terrible products are no longer found, the worst is now merely bad. The bad products have become borderline. As a result, it is just as difficult to find a

good product and the rate of rejection has remained high; however, more products tend to be those which provide activities that cannot be duplicated through the print media (e.g. problem solving), word processing programs); poor products are characterized by adequate programming but poor content development and inadequate use of the computer to individualize instruction.

The rise in our expectations for good courseware is another factor contributing to the perception of poor quality. As teachers use courseware products more often in their classroom, they begin to expect more. Consequently, what was satisfactory a year ago is no longer adequate.

4. Most courseware products released in the last three years have been in the 'drill and practice' format. It has been established by EPIE that 50% of the available products fall within this category. Approximately 20% are advertised as tutorials, although very few of these would qualify as actual tutorials and should really be included in the drill and practice category. Educational games (12%) have had a high profile as considerable marketing efforts have been directed at the home market. Simulations account for another 5% and the balance of 14% is not categorized.

5. Approximately 50% of courseware products fall within the language arts and mathematics areas. Other significant coverage is in science (15%-20%) with the next largest category being business education at 6%. Minimal coverage is provided in all other subject areas.

6. Within grade levels, the majority of products are directed at elementary grades with both math and language arts materials emphasizing acquisition of basic skills and relatively little attention to junior or senior high content. The reverse is true in science where very few products are available for elementary grades.

b. Projections for the Immediate Future

1. The rapid growth in companies and products will likely level off. More small companies will disappear either through absorption or failure and it will become increasingly difficult for small starting companies to make a successful beginning.

2. Apple will continue to dominate the educational scene with IBM mounting an effective challenge, particularly at the senior high level. Radio Shack will lose its market share to IBM as its established base of hardware becomes gradually replaced by new purchases in either Apple or IBM format. Commodore will also face attrition.

3. Quality will continue to improve but very slowly. Most successful products will fall within content topics that can not be as effectively addressed through other media (e.g. problem solving, writing skills). Some improvements in drill and practice programs will take place but this format will face a strong backlash caused by general dissatisfaction with the poor quality of drill presently available.

4. Tutorial programs will continue to be very poor in quality and hard to find. Simulations will become increasingly popular as developers discover their potential.

5. The present trend of production in the various subject areas will continue. Core subjects will still be emphasized but the discrepancies between the production levels for each grade area will be lessened. Little significant development in other areas will take place.

6. Major publishing houses will begin tying courseware packages to their textbook series; however, there will still be inadequate coverage of the curriculum and no package or series of packages will address the full needs of any significant portion of the curriculum. CAI in the classroom will still be conducted on a piecemeal basis.

c. Roles of Alberta Education and the School Jurisdictions

1. It is unlikely that the Alberta market has sufficient importance that anything that could be done here would have an impact on the directions that the development industry appears to be taking.

II. Local Development of Software/Courseware

a. Background

1. To date, the development of educational courseware within Alberta has been extremely limited. There have been a number of successes, most notably Harvey Brown of Spirit River and a team out of the University of Alberta headed by Gene Romaniuk. Individual teachers have expressed interest and a number of locally developed products have been used within schools and jurisdictions.

2. There is general consensus that the potential for a strong developmental industry is present in Alberta. There has been considerable expertise gained at both the University of Calgary and the University of Alberta; in addition, there is a good pool of technological talent outside the educational field which can be tapped. The presence of CCLS in Calgary may serve as a catalyst in developing the potential further.

3. The Task Force on Microcomputers in Education included a recommendation within its report that consideration be given to the establishment of a local developmental industry. The Alberta government has expressed some interest in the promotion of such an industry.

b. Projection for the Immediate Future

1. As it becomes increasingly apparent that the development, as it is presently constituted will not provide materials with sufficient quality or with appropriate content for Alberta schools, more serious consideration will be given to means by which a local industry can be stimulated.

c. Roles of Alberta Education and the School Jurisdictions

1. The Alberta government will have to provide the leadership and resources if local development of software/courseware is to be a reality. School jurisdictions will be able to participate once a program is started whether through cooperative ventures or through contributions of talent from within their system. At the present time, the resources and leadership that are needed can be provided only by the provincial government, either on its own or in cooperation with the federal government, other provincial governments or private enterprise.

C. SOFTWARE/COURSEWARE ACQUISITION

I. Current Industry Standards

a. Background

1. Up to 1985, the most common practice in selling either software or courseware packages was through individual or bulk purchases. Licenses or any other arrangements were by and large not available and not open to discussion. Recently, software publishers have begun to consider site licenses more positively. Courseware publishers have begun to provide classroom packages: e.g., five or ten copies of the disk and one copy of the documentation. Site licenses are still generally not available although courseware publishers will likely follow the lead of the major software producers when such licenses are provided to industry.

2. Courseware products now generally come with a backup provided in the package although this was not standard practice for quite some time. Less frequent is the provision for purchasing a replacement disk for a nominal charge after the original has worn out - this is however becoming more commonplace. Most disks come with either a 30 or 90 day warranty and many companies provide a 30 day preview period.

3. Most courseware disks are copy protected and copyright restrictions prohibit copying. It is generally acknowledged that making a copy for archival purposes is at least morally acceptable so long as the backup (or the original) is not used. Similarly, companies which provide a backup with the package expect that it is to be used for that purpose - not for doubling the active use. The use of a single disk on more than one machine is generally not covered in the warranty statement. Some companies expect a particular copy of a product to be used on only one machine; it may not be used on another machine in the site even if only one machine is active at a time. This expectation is not commonplace. Copyright laws are generally unclear on these issues and no clear and consistent practice (or expectation) has yet been legally established.

b. Projections for the Immediate Future

1. Site licenses will become more commonplace as industry and education leaders rebel against having to buy individual copies to serve each machine in their sites. These arrangements will allow more lenient expectations in terms of the use of backups and/or the use of one product on more than one machine.

2. Large scale licensing with some producers will become more of a possibility. At present, few are prepared to discuss it as they feel there would be no way of controlling the distribution and little precedent is available for establishing a reasonable price. Provinces and states which provide centralized control over learning resources will have significant leverage if they can solve the logistical and distributional problems.

3. There is a growing militancy on the part of some producers to take organizations involved in illegal use/copying to court. Educational institutions can not assume themselves to be invisible in this regard. Some educational producers are speaking loudly about the need for some test cases to protect their interests.

c. Roles of Alberta Education and the School Jurisdictions

1. Alberta Education should pursue the feasibility of setting up provincial licensing arrangements. Where such is not possible, pressure should be brought to bear on suppliers for site licensing arrangements for products that are authorized. Neither of these may be feasible at this point in time and bulk purchase routes may have to be maintained. However, by actively pursuing the licensing route and by setting up vehicles of distribution and duplication, Alberta Education can serve in a pro-active role in effecting such changes.

2. School districts should also pursue the establishment of site licensing arrangements. However, care should be taken that negotiations are not conducted on products that are under or will likely be under discussion at the provincial level. Purchase procedures at both provincial and jurisdictional levels should make it clear to suppliers that where quality is equivalent, preference will be given to the product that is available under a licensing arrangement.

II. Acquisition and Distribution Practices in Alberta

a. Background

1. Acquisition and distribution of authorized products are administered through Alberta Education's School Book Branch. As with textbooks and other media, products are purchased in bulk and provided to jurisdictions at discounted prices (after operating costs have been included). Basic resources receive a significant 40% subsidy. Recommended products however receive only a 15% discount, a discount which is applied to a price which reflects the inclusion of operating costs on top of a bulk purchase price. As a result, the final price may not be that much better than what individual jurisdictions could negotiate on their own. Schools may purchase supplementary products from the School Book Branch but only on a special order basis. As operating costs have to be included in the price to the school and as the normal delays in going through a third party will be encountered, most supplementary products can be acquired more efficiently and economically by jurisdictions directly. As most courseware products authorized in Alberta are at the supplementary level, the support that is available through the School Book Branch for the purchase of courseware is limited.

2. MECC products are available to jurisdictions at a substantial savings. This was made possible through the purchase of a province-wide license by Alberta Education and the purchase and provision of necessary duplication and distribution equipment and services by ACCESS. Jurisdictions pay $8.00 per diskette, a charge which pays for the duplication and distribution operating costs but which does not cover the capital equipment needed or the annual license charge.

   While this license has been reasonably effective in allowing jurisdictions to acquire some courseware products at low costs, there are a number of problems associated with it:

   - MECC products, while improving, are not generally high in quality. The license is valuable as a starting library. As high quality authorized products become identified, the value of the MECC products will decrease;

- As the MECC library becomes bigger, it becomes more difficult to administer and more difficult for school jurisdictions to use effectively.
- The license has to be purchased annually and MECC has raised the purchase price significantly each year. While new products are released each year, the province still has to re-purchase the entire library. Many of these products are of little value and have seen limited use in schools.
- Not only has MECC's basic price increased each year but the basis on which it is calculated has also been changed. The present system of charging a fixed amount for each "school district" is biased against rural states/provinces where a school district may consist of 23 students as in the case of Lousana Consolidated School District in Alberta. It is possible that in 1986, private schools will also be considered as separate school jurisdictions in which case Alberta's license costs will be increased significantly.
- Schools jurisdictions which have a separate license arrangement with MECC have not encountered the same price increases each year and are thus able to conclude their negotiations and acquire the products much more quickly than has been the case for the province. As a result, pressure is brought to bear on ACCESS for similar levels of service when the cause of the delays have not been at their level.

3. Jurisdictions received a per pupil library resources grant in 1985. These funds could be applied to courseware products.

4. A number of private companies have been formed in Alberta to serve the educational courseware/software market. At the present time, schools have access to a wide selection of quality products at reasonable, per unit, prices.

5. Within jurisdictions, funds for the purchase of software/courseware have generally been found within the library budget or under general supplies. Initially, little recognition was paid to the need for significant funds to be set aside for software. This now seems to be changing with some districts applying centralized purchasing and specific budget allocations.

b. Projections for the Immediate Future

1. The need for increased assistance to school jurisdictions for the purchase of software will become more evident.

2. Site and provincial licensing arrangements will be seen as viable alternatives by both producers and consumers.

3. Serious concerns will be raised about the economics of continuing the MECC license particularly if the license costs are increased again.

4. The feasibility of the School Book Branch enhancing its acquisition and distribution services will be studied.

5. Jurisdictions will pay more attention to the need for substantial funds to be included in budgets for software acquisitions. This may affect the rate of hardware acquisition.

c. Roles of Alberta Education and the School Jurisdictions

1. Continued pressure should be brought to bear on Alberta Education to serve in a leadership role in acquiring site and provincial licenses or in making software/courseware products available to jurisdictions economical in some other manner.

2. As recommended earlier, Alberta Education should use its marketing leverage to put some site or provincial licenses in place. These should be used as pilots for establishing the necessary support systems. Subsequently, consideration should be given to refusing to acquire software/courseware products except through license arrangements.

3. Jurisdictions should re-examine their current budgeting priorities so that equal consideration is given to software acquisition as it is to hardware purchases.

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LEGAL ASPECTS OF SOFTWARE/COURSEWARE
ACQUISITION AND USE

Judith C. Anderson

Alberta School Trustees' Association

Copyright

Francis Fox, Minister of Communications for the Government of Canada, in the recent White Paper, Copyright in the Cultural Community (1984) defines copyright law as the legal recognition of the rights of creators. The White Paper further states that the purpose of copyright law is to protect the results of intellectual and creative labour. Copyright could also be defined as the negative right of preventing the copying in any medium of physical material existing in the field of literature and fine arts. In order for copyright to arise, it must be in a permanent form and composed of physical material. There is no copyright in ideas, information or plot.

The law of copyright in Canada is governed by the **Copyright Act**. The **Copyright Act** was enacted in 1914 and has not been revised since that time. The **Act** provides that copyright extends to every literary, dramatic, musical and artistic work and has been interpreted to include plans, charts, compilations, tables, computer programs, advertisements, correspondence and the like. Section 2 of the **Copyright Act** in part provides the following definitions:

> "2. In this Act
>
> "artistic work" includes works of painting, drawing, sculpture and artistic craftsmanship, and architectural works of art and engravings and photographs;
>
> "dramatic work" includes any price for recitation, choreographic work or entertainment in dumb show, the scenic arrangement or entertainment in dumb show, the scenic arrangement or acting form of which is fixed in writing or otherwise, and any cinematograph production where the arrangement or acting form or the combination of incidents represented give the work an original character;
>
> "every original literacy, dramatic, musical and artistic work" includes every original production in the literary, scientific or artistic domain, whatever may be the mode or form of its expression, such as books, pamphlets, and other writings, lectures, dramatic or dramtico-musical works, musical works or compositions with or without words, illustrations, sketches, and plastic works relative to geography, topography, architecture or science;
>
> "literary work" includes maps, charts, plans, tables and compilations;
>
> "musical work" means any combination of melody and harmony or either of them, printed, reduced to writing, or otherwise graphically produced or reproduced;"

It is interesting to note that copyright exists whether the registration procedures of the Copyright Act are followed or not. In other words, copyright is automatic in all published or unpublished works in that it subsists independent of registration. This is clearly set forth in section 4 of the Copyright Act. The obvious advantage to pursuing the registration route is the opportunity to place copyright markings on the work so that the copyright is clearly made known to any who are using the work.

Infringement of copyright is a real danger because of current school practices. Many aspects of school operation potentially include infringements of the copyright law. For example, any time that a play is performed or a movie shown or a computer disk copied, infringements of copyright may arise.

Section 17 of the Copyright Act provides that infringement of copyright is committed by anyone who copies the work or any substantial part thereof in any medium whatsoever. Specifically, section 17 states in part:

> "17. Copyright is a work shall be deemed to be infringed by any person who, without the consent of the owner of the copyright, does anything that, by this Act, only the owner of the copyright has the right to do."

This includes the owner's right to produce, reproduce, perform, publish, translate, record, perform in public or broadcast.

There are exceptions to copyright infringement provided for in the Copyright Act. Although two of the exceptions could be relevant in certain school situations, it is unlikely that any of the exceptions apply to software/courseware acquisition. For example, an exception for "any fair dealing with any work for the purposes of private study, research, criticism, review, or newspaper summary" could possibly be used by an English teacher who reproduces an article or substantial portion of a literary work when the purpose was to critique the work, but not by a computer teacher who copies a disk.

It must be stated that there is no blanket exception in the Copyright Act for "educational purposes". Education is subject to the Copyright Act as is any other sector of our society.

Responsibility for Infringement of Copyright

It requires no explanation to state that the person having caused the act of copying is subject to the consequences of his or her act. This means that a teacher who copies a computer disk without authority must bear the responsibility of the infringement which he or she has committed.

In addition to the immediate contravener, the educational institution may also be subject to some responsibility. If the educational institution has condoned or approved the act in some form, responsibility will arise. The approval could arise through indirect as well as direct means. An omission to take adequate measures to prevent the perpetration of an infringement when the educational institution should have reason to suspect that an infringement may be occurring could give rise to responsibility of the educational institution for the ultimate infringement.

In one Australian decision, a school was found to be responsible for infringements of copyright by virtue of the photocopying equipment made available in the school. In University of New South Wales v. Moorhouse 49 ALJR 267, the court stated as follows:

> "It seems to me to follow from these statements of principle that a person who has under his control the means by which an infringement of copyright may be committed - such as a photocopying machine - and makes it available to other persons knowing, or having reason to suspect, that it is likely to be used for the purpose of committing an infringement, and omitting to take reasonable steps to limit the use to legitimate purposes, would authorize an infringement that resulted from its use."

There could be implied approval for infringement of copyright in a school setting where a school is provided with one computer program in full knowledge that three programs are required to meet the needs of the school adequately. In addition, blanks disks are provided to the teachers for their use in obtaining sufficient copies for the school. There is little doubt that, in that situation, the educational institution would be equally responsible for the infringement, as would be the immediate infringer.

It is recommended that every school jurisdiction institute policy that prohibits any infringements of copyright by any of its employees. By providing such policy, responsibility of the educational institution for infringement of copyright would be reduced and possibly eliminated.

Attached to this paper are copies of two policies for consideration in drafting similar policies for each school jurisdiction.

Remedies for Copyright Infringement

The Copyright Act contains a range of remedies to be used for infringement of copyright. The Act does not displace the ordinary civil remedies that are available pursuant to the common law for infringements. This means that civil actions for damages and other remedies such as injunctions are available for infringements of copyright.

The Copyright Act creates offences for any person who commits an infringement of copyright provided that the infringement has been committed in full knowledge of the breach. Remedies provided are fines and jail terms, although enforcement in Canada is very rare.

In recent years, resort to the criminal law has also been used against infringers of copyright. Both the fraud and theft sections of the Canadian Criminal Code offer potential remedies for authors of infringed works.

Section 338 of the Canadian Criminal Code defines fraud:

> "338.(1) Every one who, by deceit, falsehood or other fraudulent means, whether or not it is a false pretence within the meaning of this Act, defrauds the public or any person, whether ascertained or not, of any property, money or valuable security,
>
> (a) is guilty of an indictable offence and is liable to imprisonment for ten years, where the subject-matter of the fraud is a testamentary instrument or where the value thereof exceeds two hundred dollars; or
>
> (b) is guilty
>
>> (i) of an indictable offence and is liable to imprisonment for two years, or
>>
>> (ii) of an offence punishable on summary conviction, where the value of the property of which the public or any person is defrauded does not exceed two hundred dollars."

The phrase "other fraudulent means" could include the infringement of copyright by counterfeiting. In R. v. Kirkwood (1983), 5 CCC (3d) 393, the accused was charged with fraud for the sale and rental of videotape cassettes to the public. The counterfeit videotape cassettes had been obtained from various sources and duplicated by the accused. The accused was acquitted at trial on the basis that there was no relationship between him and the victims of the fraud. On appeal, the Court of Appeal held that the appeal should be allowed and a new trial ordered. The Court of Appeal, in so finding, held that there need not be a relationship or nexus between the perpetrator of the fraud and its victim when the Crown relies on the phrase "other fraudulent means". The two essential elements of fraud are dishonesty and deprivation. The Court of Appeal further stated that even if infringement of copyright could be considered theft within the Canadian Criminal Code, that is not a proper reason for giving a restricted meaning to the "fraud" section or for requiring additional ingredients as part of any fraud offence.

In R. v. Stewart (1983), 42 OR (2d) 225, the majority of the Ontario Court of Appeal held that theft charges may be successfully laid against one who "steals" confidential software. In that case, the Court stated that "there was no reason why confidential information gathered through the expenditure of time, effort and money by a commercial enterprise for purposes of its business should not be regarded as property and hence entitled to the protection of the criminal law."

An infringer of copyright may be:

1. Charged with either fraud or theft under the Criminal Code;
2. Sued by the author for damages or other civil remedies; and
3. Charged with infringement under section 25 of the Copyright Act.

The advantage of the applicability of the Criminal Code is the availability of larger penalties. A software owner may choose to proceed with multiple remedies in order to obtain the greatest advantage. Civil actions allow for recovery of damages which may be a greater incentive for the author than the greater penalty that may be levied against the wrongdoer through the criminal process. As well, criminal prosecutions are controlled by the Crown and not by the one who lays the charge. It is only in civil actions that the initiator of the action controls and guides the action to its completion.

In 1985, in the City of Calgary, the Royal Canadian Mounted Police successfully prosecuted a computer buff under the Copyright Act for pirating computer programs. The computer buff was fined $500.00. In view of that Alberta precedent, it is timely to consider the potential criminal and civil sanctions for infringement of copyright.

Employee Rights for Authorship

Section 12(3) of the Copyright Act provides that if a person produces the work under a contract of service then his master or employer is the owner of the copyright. The presumption of ownership in the employer may be extinguished by an agreement or policy to the contrary.

If it is the desire of a school jurisdiction to hire an employee to produce certain materials, it is preferable for the terms and conditions of that arrangement to be set forth in a written contract. Copyright could be dealt with as a term of that contract. Other items that should be subject to agreement where an employee is commissioned to produce certain materials for an employer include resources to be supplied by the employer, time off from regular work to author the materials, and publication rights.

Attached to this paper is a copy of a contract that could serve as a useful basis for entering into an agreement with an employee for the development of copyrighted materials.

More difficult legal questions arise where an employee develops new materials such as computer programs for use in his instruction. The computer program could be developed at home by the individual or a combination of home and school. Usually in those instances, the employer does not authorize or even know of *the materials that have been produced* by the employee. In order to provide some assistance in answering the question "to whom does the copyright belong? "a the specific wording of section 12(3) of the Copyright Act must be referenced.

> "12(3) Where the author was in the employment of some other person under a contract of service or apprenticeship and the work was made in the course of his employment by that person, the person by whom the author was employed shall, in the absence of any agreement to the contrary, be the first owner of the copyright; but where the work is an article or other contribution to a newspaper, magazine, or similar periodical, there shall, in the absence of any agreement to the contrary, be deemed to be reserved to the author a right to restrain the publication of the work, otherwise than as part of a newspaper, magazine, or similar periodical."

The key phrase in section 12(3) is "course of employment." In an English case, Byrne v. Statisco (1914) 1 KB 622, an employee who translated and summarized a speech when asked to do so by his employer newspaper, was found to have the copyright in the translated speech. The reason for this finding was that the work had been done on the employee's own time and independent of his ordinary duties.

Further cases are required before definitive answers can be given in this area. Suffice to say that this will be a controversial item, particularly in the development of computer programs that are used as teaching aids by teachers in the Province of Alberta.

Computer Software and Firmware

Sixty years ago when the Copyright Act was passed, computer software and firmware were unknown. It goes without saying that the Copyright Act makes no provision specifically for computers and their software. It is useful then to review several recent cases in order to determine how Canadian Courts and tribunals have applied the provisions of the Copyright Act to computer software.

In Canavest House Ltd. v. Lett, 2 CPR (3d) 386, the Ontario High Court of Justice held that a computer program is a "work" within the meaning of the Copyright Act. The circumstances of the case involved a former employee who had created the computer software at issue while employed by the plaintiff. The plaintiff was a company carrying on business as an investment dealer and advisor throughout Canada. Its primary business was the provision of computerized investment management products and services to institutional investors such as banks, trust companies and the like.

The most important aspect of the plaintiff's business in providing such products and services was the provision and creation of new computer programs for use in making investment management decisions.

Although the former employee admitted that copyright remained with his employer, he argued that he should have the right to keep copies of any software he developed.

The Court, in determining that a computer program is a work, as defined in the Copyright Act, stated that "a program such as this is either a novel language or an expression of thought, albeit in numeric form." Specifically, the Court ordered that the defendant be restrained from:

1. Infringing or attempting to infringe the plaintiff's copyright and computer programs developed by him while in the plaintiff's employ by copying, reproducing or using the software or otherwise infringing or attempting to infringe the plaintiff's copyright and software; and
2. Disclosing to any person any information concerning the software, including any documents, notes, papers or other materials concerning the software.

A similar decision was reached in Spacefile Ltd. v. Smart Computing Systems Ltd. et defendants, 75 CPR (2d) 281. The Ontario High Court of Justice granted an injunction against the defendant, a former employee who had stolen a computer system belonging to the plaintiff, his former employer. The defendant was marketing a computer package consisting of a source code and the manual which gives the instruction on how to use the source code and the programs. This package was almost identical to the plaintiff's. The defendant's programs to a great extent were similar to the plaintiff's although there were additions to and capabilities that were greater than the plaintiff's. Notwithstanding the fact that the source code and the programs were electronically recorded on disks, the Court found that they were original ideas expressed in a particular form so were the proper subject matter of copyright.

The Federal Court of Canada, Trial Division, has rendered contrary decisions in this area in the last two years. In International Business Machines Corporation et defendants v. Ordinaturs Spirales Incorporated/Spirals Computers Inc., et defendants', 80 CPR (2d) 187, Justice Reed of the Federal Court granted an interlocutory injunction restraining the defendants from infringing the plaintiff's copyright in a computer program BIOS. The defendant was selling, in Canada, a computer imported from Taiwan which contains a copy of the BOIS program recorded in a read only memory. The plaintiff had published a listing of the source code and object code of the IBM BOIS program together with other technical specifications in the technical reference manual for the IBM Personal computer. The plaintiff had also registered copyright in the published literary work IBM Personal computer input/output system 1.0.

Justice Reed found that copyright in a literary work is not limited to information and instruction for literary enjoyment. To be protected, the program need not communicate information or instructions only to human beings. He found that copyright is essentially concerned with the expression of ideas in composition or language rather than with the function or purpose of those ideas. As the BIOS program had clearly been reduced to material form in the published technical manual and as the object code was a reproduction or adaptation of the program in written form, the Copyright Act applied.

In 1985, the Federal Court refused an application for an interlocutory injunction in Apple Compter Inc., et defendants v. MacIntosh Computers Ltd., et defendants, 3 CPR (3d) 34. The plaintiffs applied for an interlocutory injunction to restrain a large number of defendants from infringing the copyright in computer programs called "Autostart ROM" and "Applesoft."

Justice Cullen, in considering the merits of the application, provided workable definitions of types of computer programs. He stated that an "application program" is designed for a specific task ordinarily chosen by the user such as to maintain records, perform certain calculations or display graphic charts. Application programs, he found, are normally written in high level languages that are designed to be easily used by the unsophisticated. An "operating system program" was designed primarily to facilitate the operation of application programs and perform tasks common to any application program such as reading and writing data to a disk. Without an operating system program, each application program would need to duplicate its functions. Both application and operating system programs can be expressed in what is known as source code or an object code. Computer programs can be recorded and stored in various components of a computer system.

The two programs at issue in this action were called "Autostart ROM" and "Applesoft." The Autostart ROM is a collection of fairly short programs which initiate registers and other circuitry in the APPLE II PLUS computer when power is turned on and which perform a variety of hardware oriented functions during operation such as accepting key strokes in controlling character generation for the video display. Applesoft is Apple's version of BASIC language. Among features supported by Applesoft are colourgraphics, high resolution colourgraphics and direct analog inputs.

The Court rejected the application for an interlocutory injunction as the Court held that the defendants had established that they had an arguable case on all of the issues and should be entitled to put the case at a trial of the action. The defendants took strong exception to the plaintiffs' claim to copyright for the programs. The defendants alleged that the programs were not subject to copyright pursuant to the Copyright Act.

In 1984, the Quebec Superior Court in La Societe D'Informatique R.D.G. Inc. v. Dynabec Ltd. et defendants, 6 CPR (3d) 299, also determined that copyright exists in a computer program and a software package. That decision was upheld on appeal in 1985 (6 CPR (3d) 322). The Ontario Court of Appeal, on appeal, held that a source code program can be considered a literary work. The object code can be considered a reproduction of the source code in any material form.

These cases are cited as examples of recent decisions concerning copyright and computer programs. Future decisions will no doubt clarify the situation further.

Licensing Agreements

In view of the legal questions that exist regarding the application of the Copyright Act to computers and computer programs, licensing agreements have become an effective and commonplace method of protecting software against unauthorized use by customers. This method is commonly used by distributors to school jurisdictions.

Rather than buying the software, the customer is licensed to use the software for authorized purposes only. The license agreement defines the authorized purposes and prohibits any other use of the software. The uses as authorized by the license agreement are designed to meet the needs of the software distributor and its customers rather than being dictated by legislation.

Many school jurisdictions have purchased software and, in doing so, have entered into a license agreement. Where a license agreement exists, all employees who use the program should be familiar with its terms. Any branch of the license agreement could result in damages against the school jurisdiction.

Patents

A patent is an absolute monopoly prohibiting the putting into use by others of a new manufacturing technique or article invented by the patentee. Patents have been found not to be a useful method of protecting most software. The Federal Court of Canada in Schlumberger Canada Ltd. v. Commissioner of Patents, (1981) 56 CPR (2d) 204, a computer program which performed calculations according to mathematical formuli on SEISMIC data to produce information useful in oil and gas exploration was held not to be patentable. The Patent Appeal Board, when considering the same cases, re: Application #096284 (1978) 52 CPR (2d) 96 made the following statements:

1. "claims to a computer program per se are not patentable;

2. claims to a new method of programming a computer are not patentable;

3. claims to a computer programmed in a novel manner, expressed in any and all modes, where the novelty lies solely in the program or algotirthm, are not directed to patentable subject-matter under section 2 of the Patent Act.

4. claims to a computing apparatus programmed in a novel manner, where the patentable advance is in the apparatus itself, are patentable; and

5. claims to a method or process carried out with a scientific novel apparatus devised to implement a newly discovered idea are patentable."

Copyright Revision Proposals

The Federal Government has recognized for some years the need to revise the Copyright Act. Various government proposals and white papers have been put forward outlining suggested revisions. Consensus on the issues is very difficult in view of the two conflicting needs; the need to provide adequate protection for the original authors of works on the one hand, and the need of society to benefit fully from the innovations and original works created on the other hand. Difficulty in the enforcement of copyright laws is also a major hurdle to overcome or remedy in a new Copyright Act.

In the most recent Federal Government White Paper From Gutenberg to Telidon, proposed revisions for the Copyright Act are outlined. Several of the proposals are relevant for school purposes. In view of the need for educational institutions to have rapid and easy access to copyright materials, it is proposed that the current scope of exemptions be broadened by providing "a limited specific exemption for public performances for educational purposes and educational broadcasters" to be granted a limited exemption in order to facilitate in-house educational broadcasts. A blanket exemption for educational institutions is not being proposed.

It is proposed in the revisions that computer programs be protected as follows:

1. Programs in human readable form will be protected as traditional literary arts.

2. Programs in machine readable form will be given a special regime of protection, the term of which will be limited to five years following the year of publication.

3. Mandatory marking requirements will be established for published programs.

It is noteworthy that the revisions also include new and strengthened methods for dealing with infringements of copyright. The intent of the revisions is to make it easier to detect copyright infringement and to strengthen the penalties to be levied against infringers of copyright.

Many potential lawsuits against infringers of copyright are "on hold" until the Act is revised. Schools have been most successful to date in avoiding infringement legal actions. That success will no doubt be short-lived when a new Act is introduced and new methods of detecting and prosecuting infringements are legislated. Infringement of copyright is, and will be, a serious matter that should be eliminated through whatever means are available to school jurisdictions.

THIS AGREEMENT made in quadruplicate this day of , A.D. 1982.

BETWEEN:

THE BOARD OF TRUSTEES OF THE SCHOOL
DIVISION NO. (hereinafter referred to from
time to time as "the Board"),

OF THE FIRST PART,

- and -

, of the Town of in the
Province of Alberta, and
(hereinafter jointly
referred to from time to time as "the Teacher"),

OF THE SECOND PART.

WHEREAS while in the employ of the Board, the Teacher has developed certain teaching materials, more specifically identified in Schedule "A" hereto;

AND WHEREAS for purposes of assisting the Teacher in the development of those teaching materials referred to in Schedule "A" hereof, the Board has provided time off from regular teaching duties to the Teacher;

AND WHEREAS in recognition of the contribution by the Board to the Teacher of time off from regular duties for the purpose of enabling the Teacher to create teaching materials, the parties are desirous of entering into this Agreement governing the manner in which the Board will acquire copies of those materials developed by the Teacher described in Schedule "A";

NOW THEREFORE the parties hereto agree as follows:

1. It is agreed that the teaching materials that are the subject of this Agreement are more particularly set out in Schedule "A" hereto.

2. That the Teacher covenants and warrants to the Board that the materials set out in Schedule "A" are an independent creation of the Teacher's and do not infringe any copyright, patent or other law or regulation affecting or relating to items such as teaching materials.

3. That the Teacher acknowledges a contribution by the Board in the creation of those teaching materials identified in Schedule "A" by virtue of the Board having provided to the Teacher time off from regular teaching duties to the extent of one hundred and twenty-five (125) hours. It is further agreed that the number of hours provided by the Board to the Teacher as time off from regular teaching duties, represent approximately twenty-eight percent (28%) of the time invested by the Teacher in the development of the teaching materials.

4. That the Board and the Teacher agree that the Teacher is free to market the teaching materials referred to in Schedule "A" and that the revenue from any such sales of the teaching materials shall be the sole property of the Teacher, provided however, that the Teacher agrees to indemnify and does hereby indemnify the Board from and against all actions, causes of action or claims that may arise as a result of or arising from the sale or use by any third party of the teaching materials developed by the Teacher.

5. The Teacher and the Board agree that in consideration of having provided to the Teacher the time off from regular teaching duties, and in consideration of foregoing any share of revenue generated by the sale of the teaching materials, the Teacher shall supply to the Board copies of the teaching materials identified in Schedule "A" together with any modifications, replacements, substitutions at no cost to the Board, and in the event of the Board experiencing any difficulty in successful operation of the teaching materials which are not related to hardware, the Teacher shall supply such assistance as is necessary at no cost, to ensure that the Board is in possession of workable and working teaching materials as identified in Schedule "A".

6. The Board and the Teacher agree that if copyright exists in the teaching materials described in Schedule "A", that copyright shall be deemed to reside with the Teacher.

7. The Board agrees with the Teacher that the Board shall make use of those copies of the teaching materials and any amendments, replacements or substitutions provided to it at no cost by the Teacher, only for purposes of instruction within the schools of the School Division and will not make or reproduce any copy of the whole or any part of the teaching materials without the written permission of the Teacher so to do, nor shall the Board permit or suffer any of its servants or agents to make or reproduce any copy of the whole or any part of the teaching materials. It is understood and agreed, however, that the Board shall not be responsible for taking any more than ordinary precautions to prevent such copying or duplication, and it is agreed that a general directive by the Board to its employees to refrain from any such copying or duplicating will be a sufficient precaution on the part of the Board.

8. This Agreement shall become effective on the date of its execution by the parties hereto, and shall continue in full force and effect during the period of time in which or for which the Teacher continues to market the teaching materials described in Schedule "A" hereto or any alteration, modification, substitution or replacement therefor.

9. The respective rights and obligations of the parties created hereby are personal to the parties and shall not be assigned by either of them without the permission of the other party first had and obtained in writing.

IN WITNESS WHEREOF the parties hereto have executed this Agreement, the day and year first above written.

THE BOARD OF TRUSTEES OF THE SCHOOL
DIVISION NO.

Per: ______________________________

Per: ______________________________

Per: ______________________________

Per: ______________________________

Per: ______________________________

Grande Prairie S. D. #2357

Policy And Operations
Manual

CODE:
TITLE: Computer Software

APPROVED:
AMENDED:

PAGE: 1 of 2
LEGAL REFERENCE:

The Grande Prairie School District intends to adhere to the provisions of copyright laws in the area of microcomputer programs.

Procedures

1. The legal, ethical, and practical problems caused by software piracy will be taught in all schools and brought to the attention of all teachers in the District.
2. Illegal copies of copyrighted programs may not be made or used on school equipment.
3. Legal or insurance protection of the District will not be extended to employees who violate copyright laws.
4. When software is used on a network system, efforts will be made to secure this software from copying.
5. Not withstanding the above, District employees are authorized to make archival copies of copyrighted software, if such are not provided.
6. District employees and agents are authorized to make a copy or adaption of a computer program provided that such a copy or adaption is a necessary step in the utilization of the computer program with a machine and that it is used in no other manner.
7. The Secretary-Treasurer of the School District is designated to sign license agreements for software for schools in the District.
8. The principal of each school is responsible for enforcing these procedures at the school level.

COMPUTERS AND COMPUTER SOFTWARE

Computers and computer software purchased by School District funds are for the enhancement of the Instructional Program.

Each school will establish general guidelines governing the use of school machines for games and other non-educational uses of system computers. All pupils will be made aware of the school guidelines.

Under no circumstances are computers or computer software to be used in a manner which is in violation of copyright law.

TEACHER TRAINING:

A PRELIMINARY DISCUSSION PAPER

Dale Burnett

Hank Boer

INTRODUCTION:

It is our view that the teacher is the single most important factor in effective classroom instruction. Any consideration of the impact of computer technology on education that fails to acknowledge what teachers do in classrooms is likely to be ineffective. Hardware, software, and teacher form a triad necessary for the effective instructional use of technology. Inservice and training binds these three components of the triad. Therefore, inservice and training should receive high priority.

This report consists of two sections: (I) Overview of Inservice and Training of Educators for Educational Computing, and (II) Identified Issues re Teacher Training and Computers in Schools. The intention of the following report is not to provide definitive answers but to stimulate discussion and reflection on the complexity and magnitude of the issues raised. Convergence toward suggested priorities and solutions will hopefully occur during the meeting, but it is even more vital to ensure that as many important issues and perspectives as possible are at least identified.

Part I

Overview of Inservice and Training of Educators for Educational Computing

The inservice and training of educators in the use of computers in education consists of challenging and changing activities. These activities are challenging because the inservice and training can be directed to a technology that has application at all grade levels, in all subject areas and in a variety of instructional settings. It is changing because the technology and its materials for instruction are undergoing continual and at times drastic change in effectiveness, power and utility. This technology and its materials is not available to all educators because of its cost.

The inservice and training of educators is a complex task because it must meet the needs of educators at various grade levels and subject areas; also, it can be used in many different ways for each subject at each grade level. Therefore, it is advantageous to have teachers reach a point of independence, whereby they have the expertise to implement effectively each computer application or contact available resources to gain that expertise.

The general practice of a school jurisdiction in the use of computers can affect the type of inservice and training that could be provided. These practices are:

1. Treating computers as a general "neutral" resource that is used in many ways or in all subjects or at all levels.

2. Treating computers as a resource for specific programs where they are used in a few ways or in certain subjects or at certain grade levels.

3. A combination of 1 and 2.

If the computer is considered a "neutral" resource then inservice and training is complex and must meet many educator needs in a variety of education needs in a variety of educational situations. In addition, complex inservice tends to be long-term. Alternatively, if the computer is used as a specific resource then the inservice can be directed to that specific educational situation and would tend to be short-term.

The scope and type of inservice is largely dependent upon the mission, goals and objectives established at provincial, school jurisdiction, school, and class levels. Inservice should not occur until the mission, goals and objectives have been identified. Once the mission, goals and objectives are established then the necessary inservice programs and their resources can be implemented.

A variety of resource people can be used to do inservice and training of educators. The decision about which resource people to use will depend upon budget factors, availability of expertise factors, and inservice goals. These resource people might come from the following sources:

a. Computer expert (district leader)
b. University instructors
c. College instructors
d. Private consultants
e. District computer consultants
f. Inservice coordinators
g. Subject consultants
h. Computer consultants (other district) and
i. Subject experts (district teacher)

Ideally, the best person for the job has a good understanding of the needs of the educator in that particular teaching situation, and has the necessary professional skills to provide competent services.

It is the writers' opinion that many inservice activities have occurred in the province but have been ineffective for a variety of reasons. Typically, they have not occurred in some or all of these conditions:

1. After the inservice there must immediate availability of hardware, software, and instructional materials to the teachers.

2. Teachers must be shown how and be given sufficient time to integrate the use of computers in their instruction.

3. Inservice and training should be conducted by persons with level subject and courseware knowledge.

4. Inservice and training should be conducted by persons who have expertise in conducting inservice and training for educators (comprehensive computer expertise is not essential).

The preceding list is in no way complete, but does provide some guidelines for establishing conditions for effective inservice.

There are stages that districts or schools typically go through when implementing computer technology and inservice programs. These are listed as follows:

1. Pre-introductory (grassroots)

   -a few teachers on their own initiative implement computers in their classrooms
   -teachers use public domain software or write their own
   -emphasis on computer literacy
   -purchase computers through fund-raising
   -conducted by instructional resources, after school or during conferences.

2. Introductory

   -introduce computers to small groups of teachers
   -short inservice and training of a general nature (1 to 3 hours)
   -emphasis on how to operate the computer
   -deals with computer phobia
   -conducted by instructional resources a-h

3. General Literacy

   -inservice and training of larger groups of teachers
   -typically 5 to 20 hours duration
   -topics include literacy, programming, wp, marks, and CAI software
   -opportunity to view courseware
   -may include extended courses in BASIC, LOGO, PASCAL, etc.
   -conducted by instructional resources a, b, c, d, e, h

4. Introduction to Courseware and Problem-solving

   -inservice and training to small or large groups
   -review of courseware design, evaluation, and selection
   -review of implementing courseware in the classroom
   -viewing of approved courseware
   -conducted by instructional resources b, c, d, e, f, h

5. Courseware and Problem-solving Implementation

   -short workshops on single pieces of courseware
   -typically 3 to 40 hours
   -workshops are oriented towards subject and use thereof in the classroom including instructional strategies
   -workshops conducted by subject experts including instructional experts b, c, d, e, f, g, h, i

6. Courseware and Problem-solving Integration

-workshops and inclass assistance on implementing specific pieces of courseware in a subject area
-usually short-term and ongoing
-conducted by instructional resource e, f, g, i

Ideally the implementation of computers should have as a predominant goal the total integration of the technology in schools. Computer technology inservice should strive to produce independent users of computers for instruction who continually receive additional upgrading and training.

Inservice programs will change as the technology and its instructional application continue to change. New inservice programs will be continually designed and modified to meet these future changes.

Part II

Identified Issues re Teacher Training and Computers in Schools

Structure of Contents

- 1.0 Funding
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- 5.0 Impact on the Curriculum
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    - 5.3.1 Obsolete
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- 6.0 Alternative Delivery Models
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7.0 Trustee Education
8.0 Administrator Education
    8.1 Administrative Functions
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9.0 Human Resources
    9.1 School Personnel
    9.2 Faculties of Education
    9.3 Colleges
    9.4 Regional Consultant Teams
10.0 Evaluation
11.0 Efforts Elsewhere
12.0 Individual Initiatives
13.0 Priorities

INTRODUCTION

It is important to keep in mind while reading the following that it is purposely delimited to TEACHER TRAINING, while at the same time recognizing that most of the issues raised do not lend themselves to such a neat compartmentalization. There are many natural overlaps and relationships with issues to be raised by the other working groups.

1.0 Funding

One important issue here is that of perspective. Perspective implies awareness of different levels: What percentage of the provincial budget is dedicated to education? Relative to competing demands, is this percentage likely to change? In dollar terms, what does this percentage translate to? Within education, how is the budget sub-divided? In how many different categories are there items related to teacher training? Should some of these categories receive more or less? Should new categories be added? How public is this information, and how easy is it to obtain?

1.1 BQRP

Is there some form of status report available on the activities that have occurred to date under this plan? Assuming yes, what are appropriate next steps? The focus here is on teacher training. Has this plan created new demands for teacher training (or not)? Is there a differential impact on teachers with different specializations?

1.2 Other government funding

What about creating analogous support budgets for other segments of the school system, such as elementary and junior high schools? More particularly, what types of budget categories exist, or should be created, that are related to teacher training? It is possible to obtain estimates on the actual or relative amounts of money that is being spent on hardware, software, and personnel?

1.3 Non-government funding

What is the role of the ATA in supporting teacher training programs?

2.0 Access to Hardware

What types of resources should be available in schools? Who decides? Are the needs different at different grade levels? There are questions of quantity (How many machines and where should they be located?) as well as quality (What type of machine should we have in a particular context?). Are there geographic disparities? How does this impact on teacher training?

3.0 Access to Software

The issues here are analogous to those raised in the previous section.

4.0 Establishing Provincial Goals and Objectives

Once again, perspective. Within the overall educational enterprise, which instructional goals have a potentially strong relationship to computer technology? To what extent are our teachers aware of these?

5.0 Impact on the Curriculum

The following sections apply in varying degrees to every subject area and grade level. Who is looking at this? How are teachers being informed? What support is there to implement these changes?

5.1 What should be altered?
5.2 What should be added?
5.3 What should be deleted?
  5.3.1 Obsolete
  5.3.2 Lower priority

6.0 Alternative Delivery Models

The intention of the following sections is to recognize the wide variety of approaches that are already in place as well as to stimulate thought on new possibilities.

6.1 Sabbatical leaves
6.2 Distance education
  6.2.1 Opportunities for hands-on expertise

Many experienced computer users testify to the importance of hands-on activities in the development of their expertise. Are there ways by which the possibility of easy hands-on access can be increased? For example, is there some way in which a substantially larger number of micros could be placed in the homes of teachers, where they could use them at convenient times?

  6.2.2 Access Alberta
  6.2.3 Athabasca University
  6.2.4 Correspondence courses
  6.2.5 Computer conferencing/networking

6.3 Pre-Service Programs
  6.3.1 University of Alberta
  6.3.2 University of Calgary
  6.3.3 University of Lethbridge

6.4 In-Service Programs
    6.4.1 Professional development days
    6.4.2 Regional conferences
    6.4.3 Workshops
    6.4.4 Credit courses
    6.4.4.1 Diploma programs
    6.4.4.2 Graduate programs

6.5 Release time arrangements
    6.5.1 Half-time appointments
    6.5.2 Half-day and full-day study leaves
6.6 Teacher exchange programs

7.0 Trustees Education

Trustees are often required to make important budgetary decisions regarding items related to computers and to teacher training. How well informed are they? What support is there for them to acquire the necessary background to make informed decisions?

8.0 Administrator Education

8.1 Administrative functions

Where can school administrators learn more about the various software and hardware systems designed to assist in the administration of a large organization?

8.2 Educational philosophies

How are administrators being informed of changing priorities and philosophies within the classroom? How often do they understand why a teacher is attempting to undertake the particular (computer) approach that he or she is following?

9.0 Human Resources

This section is intended to identify the various resources that are potentially able to assist in teacher training issues related to computer technology.

9.1 School personnel

Many schools and school jurisdictions have individuals who are well qualified to provide assistance to practicing classroom teachers. Is this expertise being well utilized? What provision is there for release time to permit one teacher to help another?

9.2 Faculties of Education

9.3 Colleges

9.4 Regional consultant teams

10.0 Evaluation of Efforts

What efforts are being made to evaluate ongoing activities in Alberta? How much attention should be paid to formal evaluation activities?

11.0 Efforts Elsewhere

What are other provinces and countries doing? What are the possibilities for joint programs, perhaps using computer conferencing and networking systems?

12.0 Individual Initiatives

Much discussion about teacher training centers on various ways in which the overall system can provide support for teachers. How much emphasis should be placed on the individual to initiate and arrange for his or her own personal growth and development.

13.0 Priorities

13.1 What is the single most important issue facing teacher training in Alberta? What is a reasonable next step to take?

13.2 What are a few other issues of major importance?

13.3 Can some of these issues be identified as short-term or long-term?

13.3 Are there a few things that can be done immediately that would be helpful?

INSTRUCTIONAL NETWORKING
IN THE CLASSROOM

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INTRODUCTION

Microcomputers first appeared in the marketplace during the last half of the seventies. The earliest models were marketed as kits which were intended to be assembled by the purchaser. Once assembled, they typically had minimum amounts of memory (because memory chips were expensive) and could only be programmed in "machine language." This made them more of a curiosity than a useful tool.

By the end of the seventies, microcomputers were being marketed as "ready built" units and the cost of memory had dropped sufficiently to allow a typical microcomputer to be equipped with enough memory to allow it to be programmed in higher level languages. Many early systems used cassette tape recorders as program storage devices but these proved to be both slow and unreliable and were soon replaced by floppy disk storage devices.

By 1981, microcomputers had evolved to the point where schools were beginning to look closely at their potential for instruction, both for computer assisted instruction (CAI) as well as a means for learning about microcomputers and their uses (computer literacy). The total number of microcomputers in Alberta schools on January 1, 1981 was 256.

During the years that followed, a number of very significant trends were evident. First, the cost of microcomputers was dropping while the power increased dramatically. As an example, the same amount of memory that cost $750 in 1981 could be purchased in 1986 for less than $10. Second, large quantities of software (particularly CAI software) was being developed for use with microcomputers. For example, the total number of CAI programs available for the APPLE microcomputer is currently more than 6,000. Third, a new category of software products called productivity software began to evolve. This included software designed to perform functions such as word processing, data base management, spreadsheet analysis and communications functions.

These developments resulted in an exponential increase in the number of microcomputers in Alberta schools. A survey conducted in January of 1985 reported that there were more than 16,000 microcomputers in Alberta schools. Based on data gathered during this survey, it was estimated that this number would double within the two year period following the survey. Furthermore, the survey reported that nearly half the schools had established "laboratories" in which varying numbers of microcomputers were housed. Within the period of four years (1981 to 1985), it had become clear that microcomputers were having a significant impact on Alberta schools.

EMERGENCY TRENDS

It is easy to tell which teachers in a school are using microcomputers. They carry boxes of floppy disks around with them. However, as the number of microcomputers in Alberta schools continues to grow, it become obvious that carrying around boxes of floppy disks is not a satisfactory way to store and distribute programs in a classroom.

One solution to the problem of program storage and distribution that has been proposed, and one that is currently being tested in a number of schools in Alberta, is use of a local area network (LAN). The concept of a LAN involves interconnecting a number of machines in a classroom, using some form of cabling. One of the interconnected machines then becomes a "host" machine and is dedicated to facilitating communications on the network and communication with mass storage devices (such as fixed disks and printers). The advantages of using a LAN include the economies of shared resources (fixed disk storage for storing software and a printer) and the convenience of distributing software via the interconnecting cable rather than by physically handing out floppy disks. The disadvantage is that one unit must be taken out of production to act as the host. However, there are a number of new issues that arise as a result of the introduction of LANs in the classroom. The remainder of this document will briefly discuss some of these issues.

ISSUES ARISING AS A RESULT OF LAN IMPLEMENTATION

A. Economic Issues

As discussed earlier in this document, the use of a LAN can offer some economies in that a single, high capacity fixed disk can be used as a shared program storage device by the entire class. This can (depending on the specific application) eliminate the need to equip student stations with individual floppy disk drives. This feature of the LAN does not usually result in a net saving since the amount of money saved as a result of not buying floppy disk drives is likely to be approximately equal to the cost of the fixed disk unit and its backup (backup for the fixed disk is essential since the elimination of floppy disk drives on student stations makes it very difficult for students to make a backup copy of their work on a floppy disk).

Some cost savings can however be realized through the use of a shared printer. In most LANs, jobs to the printer by users of the LAN are cued and automatically sent to the printer when their turn comes. In a laboratory equipped with "stand-alone" microcomputers, it would be necessary to provide several printers which students could use as needed.

One factor which tends to affect economic considerations of a LAN is the fact that one machine must be taken out of service to serve as a dedicated host. Another factor that machines configured in a LAN must be equipped with network cards which typically add $500 or more to the cost of each work station. A third factor involves the cost of acquiring the necessary network management software.

Generally, the smaller the LAN (that is, the smaller the number of student work stations) the less favorable are the economic considerations. In a small LAN (say five work stations) the cost of these items can be absorbed over a larger number of work stations, thereby significantly reducing the "per station" costs. While it may seem that the easiest way to cost justify a LAN is simply to add more work stations to it, it is important to realize that as the number of work stations increases the performance (speed of file retrieval) decreases. Therefore designing a LAN is a matter of achieving a balance, making the LAN large enough to realize economic benefits yet keeping it small to avoid performance degradation.

B. Software Issues

One aspect of installing a LAN is the fact that software can be installed on the host machine and can then be accessed by all work stations as needed. While this offers a much better solution to the problem of classroom management than distributing individual floppy disks to students, it must be pointed out that, unless the software vendor has issued the user a network license, such an installation is contrary to copyright legislation since most copyright licenses stipulate that the license covers the use of the software on one central processor (work station). Many software vendors are beginning to issue special network licenses but in many cases they do not have specific policies with respect to the use of their software in a networked environment.

Many software vendors sell their software on copy-protected floppy disks and some networks do not have provisions for accepting software from a copy-protected floppy disk. In other cases, software vendors make provisions to permit the software to be copied to the host fixed disk on a network, but, whenever the software is loaded into a student work station, the floppy disk drive (if present) on the student work station must contain the original floppy disk. This, of course, is not satisfactory since the instructor is once again faced with the distribution of floppy disks.

Many issues relative to sale of software to schools need to be resolved, and, certainly, the use of software on a LAN is a high priority issue that is yet to be resolved.

C. Management Issues

One of the most attractive aspects of a LAN is that it offers the teacher a facility which is far easier to manage than a laboratory equipped with a large number of "stand-alone" microcomputers. However, a LAN requires someone who will act as system manager. Someone must load software onto the host file server, register users, make daily backups of user files, maintain software licenses, and perform a variety of other tasks essential to the proper operation of the LAN. Who, in a typical school setting, should have this responsibility?

CONCLUSION

The intent of this paper is not to present a comprehensive examination of all of the aspects of LAN operation. Rather, it is intended to introduce the notion that the LAN is one attempt to deal with increasing numbers of microcomputers in schools and that while LANs offer some solutions, at the same time they introduce some new problems. It is hoped that some of the issues raised in this document will serve to stimulate thought and discussion relative to the use of local area networks in schools.

WIDE AREA NETWORKING

IN

ALBERTA SCHOOLS

Rick Bell

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INTRODUCTION

Research of all kinds has always been stimulated by easily accessible, reliable, and inexpensive communication among researchers with similar interests. Electronic messaging systems and database retrieval systems are designed to provide such communication. The provision of a cost effective Alberta based system with electronic messaging and data base retrieval capabilities, to allow both teachers and students to communicate with others in Alberta and across Canada, should be a top priority for those who are determining the future of computers in Alberta schools.

This paper describes the existing situation in electronic messaging and data base retrieval in Alberta, and makes several recommendations for the creation of such a system in this province. To furnish some background for the paper, a brief section entitled "Technical Considerations" is provided.

TECHNICAL CONSIDERATIONS

Each computer generates its electrical signals differently. There are variations in current, voltage levels, and the ability to generate the same combination of bits to form a character. Two standards exist that bring together the incompatible electrical signals and convert every computer's digital alphabet into understandable code. These standards are RS-232C and ASCII. The RS-232C is used to standardize the electrical signals being sent out of a computer's serial port. With it, a computer can "talk" to a printer, modem, and in some cases disk drive in understandable, common electrical signals. The ASCII (American Standard Code for Information Interchange) is the standard manner of arranging the zeros and ones so that when the 'A' key is pressed, a computer receiving the zeros and ones will know that they stand for 'A'. The majority of microcomputers currently in use in Alberta schools are equipped with ASCII-generating keyboards.

A modem is a device used to translate computer signals into audio signals that can be sent over telephone lines, and vice-versa. The majority of modems available today are 'direct connect', include a communications interface, and are simply inserted into a modular type jack. The alternative is an acoustic coupler which requires the user to make a telephone call manually. When the connection is made the handset is placed into the acoustic coupler. A choice between a modem that transmits at high speed (1200 baud) or low speed (300 baud) should also be an important consideration.

The final item to consider is the communications software. This is simply a program that will place a microcomputer in a mode to communicate and be dependent upon a remote terminal and its capabilities. The software should include the ability to send (upload from disk) and receive (download to disk) information from a host computer. A more detailed explanation will be available at the Symposium, if necessary.

ELECTRONIC MESSAGING AND DATA BASE RETRIEVAL SYSTEMS CURRENTLY USED IN ALBERTA SCHOOLS

1. ENVOY 100

An electronic messaging system permits the sending and receiving of messages on a single machine. Each user of the system must have an ID on the machine and a file under that ID, called the mailbox, into which incoming mail messages can be placed. To either send or receive mail from a particular ID, a user must sign onto or 'logon' to that ID. An originator of a mail message first creates the message under the originator's ID, using the software that is available under the operating system (O/S), and then instructs the O/S to transfer the message to the recipient's mailbox. To read the mail message, the recipient must instruct the O/S to display or print the contents of the recipient's mailbox. Through remote logons to a single computer it is possible for users of a single machine to be widely dispersed geographically.

ENVOY 100 is Canada's leading electronic messaging service, offered nationwide by Telecom Canada. Offering time-flexible, delay-free communications, it allows the user to compose, edit, send, receive and store written messages with maximum flexibility and cost effectiveness. Recent enhancements allow the user to interact with the host computer, using the telephone. Once connected, the keypad of the telephone becomes the 'keyboard', and messages can be heard by a process called voice synthesis. At present the user is unable to dictate and send a message using this method.

A cost breakdown of the ENVOY 100 service can be found in APPENDIX I. It should be noted that the ENVOY service is not time sensitive. Charges are based on kilocharacters used.

The Alberta Teachers' Association Computer Council has used the ENVOY service for more than a year now, primarily for the preparation of agendas, generation of minutes, and general exchange of computer related information. At present there are 115 teachers on the system and negotiations are under way with Telecom Canada to expand the service to students. Valuable contacts have been made with staff from schools in Ontario and British Columbia, and the idea of interprovincial communication with students of all ages is an idea worth pursuing.

2. The SOURCE

Databases such as the SOURCE provide the user with information on topics as varied as general daily news, bio-medicine, and environment design. Over 800 information and communications services are available on the SOURCE, billed as America's Information Utility. The addition of Grolier's encyclopedia and LEARN, an educational database, have made the SOURCE more appealing to educators.

The SOURCE, and in general most databases, operates on a per hour of use fee; that is, the charge is a standard connect fee depending upon the time of day and the number of minutes of use.

Several schools in Edmonton and Calgary currently use the SOURCE as a research tool. Offering Associated Press (AP), and United Press International (UPI), it enables students to search the database for the latest stories and to produce hard copy for presentation of current events to the class.

The SOURCE also provides an electronic messaging service that allows the student to interact with other users who are online simultaneously anywhere in North America, Europe, and selected Asian countries.

Costs for the service are $10.50/hr. for non-prime, and $20.50/hr. for prime time.

3. DIALOG

DIALOG Information Services, a subsidiary of Lockheed Corporation, has approximately 700 bases, storing information from more than 80 million journals, newspaper articles, reports, conference papers, and other documents. Topics include science, technology, business, current affairs, law, social science, as well as the humanities. DIALOG also has KNOWLEDGE INDEX, a scaled down version of the parent system. It is designed for the home user and has substantially fewer databases. Five schools in the Calgary area are currently using the DIALOG services.

4. COMPUSERVE

COMPUSERVE Information Service, a subsidiary of H & R Block, is one of the more frequently accessed information services. COMPUSERVE offers a range of services: business information, electronic banking and shopping, games, news services, and electronic mail. Two major programs are available. CIS (Consumer Information System) is for the general purpose user, and EIS (Executive Information System) attracts users from business and the professions. Although COMPUSERVE has not catered specifically to educators in the past, recent additions deserve some mention. Now available on COMPUSERVE is STUDENTS' FORUM, available to any junior high student with a modem. Students can use the forum to leave messages for electronic pen pals at other schools. They can help with homework, or chat, and can join in foreign language forums also. ATACC currently uses COMPUSERVE in conjunction with the SOURCE to provide its members with up to date computer related information.

LOCAL BULLETIN BOARD SYSTEMS

Currently in use in a number of districts, this type of system is somewhat limited in the information it provides. Generally, the host computer is a microcomputer equipped with software that allows it to be set up to resemble the electronic equivalent of the cork bulletin board that may be seen in the average supermarket.

Edmonton Public Schools launched their Telecommunications Initiative in September 1985. Using the NET-WORKS II software package manufactured by High Technology Software and an APPLE IIe with 128k as a host, twenty five schools have since signed on. The software is modifiable and is designed to be an electronic mail facility featuring the ability to transfer letters, documents, or ASCII text files from the central bulletin board to multiple locations or vice versa. The bulletin board is the hub through which messages may be sent.

The program creates a log of callers, which includes the time and date they called, the callers connect time, and other bits of information about the call. The system operates at 300 baud.

An evaluation of this system is scheduled for early February, at which time it may be expanded to students and parents in the district. A recommendation to operate from a hard disk will be discussed as well as the possibility of developing an electronic mailing facility using the mainframe as the host.

An example of the various options offered on a local bulletin board system are listed in Appendix II.

RECOMMENDATIONS

The following are recommendations for wide area networking in the Province of Alberta:

1. That the feasibility of a cost effective, Alberta based electronic messaging and data base facility specifically for Alberta educators be explored.

2. That a steering committee for this study be selected, representative of the districts presently involved in this type of activity.

3. That Alberta educators identify their particular needs for electronic messaging, file transfer, remote database and other services, and report their need to the steering committee.

CONCLUSION

Other recommendations may arise as a result of the Planning Symposium, which is the first step in the realization of a cost effective system serving the needs of Alberta educators.

The writer sincerely hopes that this paper has given some insight into the potential of wide area networking. I look forward to discussing the subject further with you at the Symposium.

APPENDIX I

ENVOY 100 Cost Breakdown

$50.00 to startup an Organizational Membership.

$50.00 for a one-time installation charge.

1 - 200 users......$3.00 each month.

201 - 500 users......$1.50 each month.

Any amount of users over 500......no charge.

Message Costs:

The sender pays .35 cents to send the message to ENVOY and another .35 cents when the recipient reads the message, for a total of .70 cents to send to one recipient. Additional carbon copies to other recipients are .35 cents each (e.g. a message to three recipients = .35 cents in and 3 x .35 cents out).

The above is based on a 1000 character message. One character to 1000 characters is rated at 1000 characters. Anything more than the 1000 is pro-rated.

Bulletin boards have the same cost breakdown, with the exception that the sender pays .35 cents to input the message and the recipient pays .35 cents to read the message.

All of the rates above are based on PRIME TIME USE (6 a.m. - 6 p.m.). NON PRIME TIME charge (6 p.m. - 6 a.m.) is .26 cents.

High Usage

For an organization that generates a large kilocharacter count (above 15,000 KC) the message charge drops to .30 cents in prime time, and .22 cents in non-prime.

Message Storage:

Five days free. Subsequent charges are minimal at 1/2 cent/day, or, more simply, a 1000-character message costs .15 cents/month to store.

APPENDIX II

Following is an overview of the commands that are supported by the Net-Works II software. The user will encounter these options when he or she successfully signs on to the system.

A)DVANCED TIPS: For a list of program tips (for the advanced or beginning user) consult this menu item. The SYSOP can update this file as necessary.

B)ULLETIN BOARDS: The names and phone numbers of all bulletin boards in the Edmonton area are maintained in this file.

C)HAT: If you wish to CHAT with the SYSOP (System Operator) then choose this option. If the SYSOP if available he will return your call.

D)OWNLOADING PROGRAMS: Downloading programs is not difficult and is made even easier with the three program converters provided with the NET-WORKS II software. It is possible to send and receive Applesoft, Integer, Binary, and Text files.

E)LECTRONIC MAIL: Each time a caller logs on, his mailbox is automatically checked for mail and he is informed if he has any waiting for him. You must be verified by the SYSOP to use this function.

F)EEDBACK/COMMENTS: Use this function to leave messages for the SYSOP.

G)ENERAL INTEREST TOPICS: This option takes the user to a sub-menu. Items that are asterisked are available for use.

H)ELP: Selecting this option will give a detailed explanations of all system options for the caller.

I)NFORMATION: Useful information about the system that you may want to check frequently.

K)EYBOARD MODE: Networks II defaults to upper case and 40 columns.

M)EMBER LISTING: Lets you see a list of all members currently using and verified on the system.

N)ULLS: Enables you to slow down the transmission rate.

P)OST: Selecting this option allows you to post a message on the main bulletin board.

R)EMOVE: Used to remove a bulletin board message that the caller had posted earlier.

S)CAN/READ: Displays message titles in groups of 10 beginning with the number the user wishes to start with.

T)IME: Displays various time information if a clock is configured into the system.

V)IDEO MODE: You may vary the output of text files to any video width up to a maximum of 80 columns.

W)ELCOME MESSAGE: This message is displayed only for the first time caller.

X)PERT MODE: A toggle switch that either bypasses system menus or bypasses them. It can be toggled simply by selecting the option.

Y)OUR STATUS: Informs the user how many times he has called, how many free programs he has received, how many bulletins he has posted, which special functions are in use etc.

ELEMENTARY COMPUTER EDUCATION

Walter Savill

Project IV Computers

Calgary Board of Education

I. INTRODUCTORY COMMENTS

This document was created because I wanted to record the trends and changes that I have observed from working with computers over the past 15 years and, in particular, the last 8 years in education. It contains strictly my own observations, with which the reader may disagree as he or she sees fit.

2. HISTORICAL PERSPECTIVE

2.1 The Programming Era

This extended from 1975 to 1982 and was characterized by an attempt to get students to be programmers of computers. In 1975, as a student teacher, I was assigned to a group of gifted students and decided to try a computer unit with them. The only thing I knew how to do was program a computer, and that is what I tried to impart to these students. A few years later, when the micro-computer made its appearance, this was a common occurrence. In Calgary, it was the Education Assistance Service for Gifted Children that walked into Earl Grey School with two Commodore Pet computers and the question "what can we do with these?" The answers were "a few games such as artillery simulator" and "programming in BASIC." Those were what people who knew about computers had done, and they were also the easiest things to teach.

In the latter stages of the programming era teachers tried to find justifications for teaching programming. Statements such as "If they can program a computer then they must be able to solve the problem themselves" and "Programming will help students to understand sequential thinking," were made. Some of these same statements are made today to justify the teaching of computer languages, although there is little evidence that it actually works.

The era ended because the computer specialists realized that teaching computer languages to students, or in fact to their colleagues, was a very difficult task in the time that could be gleaned from the elementary curriculum. This was especially true because most of the elementary students could never understand some of the abstract concepts and thinking modes that computer programming demands.

2.2 The Computer Literacy Era

After attempting to teach students to program, most teachers were willing to try something else. If elementary students couldn't program the computer at least they could learn the proper use of such programs as were available. Also, there was a prevailing belief that education was severely out of step with technological advances and that some program of studies, which would prepare students for the computer age, must be embarked upon at once. Were this not done then our graduates would be unable to obtain jobs without retraining, and this must be started in the elementary school when minds were young and flexible.

A push for materials was embarked upon, starting in 1979 and culminating in the "Computer Literacy Guide" published by the provincial government. This document has been in effect until today but is presently under review, and it would appear that the term literacy is being dropped.

The major goals of computer literacy are to become familiar and comfortable with computers. These include a study of the operation of a computer, the history of computers, and the potential of computers and how they affect daily lives.

The era ended because teachers could not justify taking the extra time from regular studies. It also appeared that students were becoming comfortable with computers in spite of our belief that they weren't going to get that way without us. The games arcade played a major role during this era because students were becoming computer literate through exposure. In fact, it appeared at time that the only thing a computer could do was play games, at least in the eyes of students and some teachers. This was not enough to justify the tremendous expense being spent on hardware and inservice. With the reduction in interest in computer games, a corresponding drop in interest in computer literacy was felt. Also, a basic assumption of the literacy program was that programming would be left to junior and senior high schools. LOGO is a computer language which gave many people the belief that anybody could program a computer.

2.3 The Computer Integration Era

The last major thrust in computer education for the elementary school was to find means by which the computer could be integrated into the existing curriculum. This paralleled the development of educational software and its evaluation by agencies such as Alberta Education's Clearinghouse. It was hoped that material of sufficient quality for use in the classroom could be found. This included not only computer assisted instructional materials but things such as word processors, data bases, telecommunications systems, and LOGO. Whatever! The study of computer literacy or programming was to be left behind because students were going to learn it anyway and would start to use the computer in mathematics, language, social studies etc.

The era ended rapidly when it was realized that for every scheme developed time had to be spent training students to use the materials. Some packages, such as many CAI materials, required very few operational skills. Others, such as word processors and LOGO, required considerably more. The importance of this era was that it established the computer as part of the schools program, as opposed to being a separate entity to be taught. It is interesting to note that the era did not involve a great deal of planning; it could still be termed part of the experimental period of computer education.

3. PRESENT-DAY PHILOSOPHY - THE HYBRID ERA

All eras up to this could be classified as experimental. Nobody knew what should be done with computers in classrooms and the programming, literacy and integration experiments have been carried out with mixed success. This new era is characterized by planning. Teachers and computer specialists are discussing the experiments and are pulling out those parts from each that fit into the program of studies. They are also preparing the students with the appropriate operational skills to accomplish the educational objectives.

An example of this type of thought is the word processor. Initially teachers gave students the word processors in the hopes that they would edit. Just giving a word processor to a person does not make them an editor. However, it was found that the editing skills from writing and the editing features from the word processor must be taught. Also, if one is going to make a word processor useful, one had better teach a student to keyboard. This kind of thought demands planning, goal setting and establishing objectives. The computer has lost its initial mystique and it is time to think long and seriously about how it is useful to us.

3.1 The Computer as the Teaching Assistant - TUTOR

The use of a computer for drill and practice has been widely criticized by computer educators because it was such an unworthy use of a computer. The computer is a "dumb" machine which can look smart because it is fast and accurate. If something is important in drill and practice it is that the learner gets fast and accurate feedback. A machine to provide just that is desirable.

If used with planning and by carefully integrating the computer into the curriculum, drill and practice can be a highly effective tool. Most drill and practice programs are very easy to learn, can be done in less than 1/2 hour (something to be admired when hardware is in short supply) and it works (at least research shows this result). This is not to condone "fancy page turners" or programs that lack student involvement. These programs should probably be removed, but not every elementary student will be able to use a turtle as a problem solving tool to analyze moving bodies in the absence of gravity. A great deal of reinforcement in the knowledge and application areas of cognitive development occurs in the elementary school.

Drill and practice has its place and will undoubtedly be used because it is generally easier for students and teachers to learn how, and it does not demand a heavy commitment of resources, both human and machine.

To this point in time, most computer programs provide reinforcement of concepts instead of teaching concepts. Programs which provide instruction are rare for microcomputers; the ones in existence are not widely used and are highly criticized. One of the biggest promises of the computer age was for programs which would analyze student weakness and branch to an appropriate lesson automatically. Some of these computer managed learning systems can be purchased, usually at great cost. The CML programs appear to be either too unreliable or too costly for widespread use. They are being replaced by the new "catch phrase" - the "expert systems."

3.2 The Computer as the Assistant to Student Work - TOOL

Examples of computer tools are word processors, data bases, spread sheets, simulation programs, some LOGO applications and graphics programs. These programs will allow a student to improve either the quality or quantity of his or her work. They do not generally have a role in the instructional objectives of a teacher but they will enable the objectives to be accomplished in a reduced time, with reduced effort or with improved results.

These programs are generally harder for the students and teachers to use and will require a longer period for learning the operational skills needed to run the tool. For example, to use a word processor effectively students must first attain a keyboarding speed that is greater than their handwriting speed and learn the various commands involved with the particular word processor being used. It has often occurred that more time has been spent learning to use the word processor than has been spent operating it. If the use of computer tools are to be included in the elementary school, then increased awareness of the higher level skill requirements must be made.

Some computer tools are easy to use. Graphics packages such as Print Shop have low operational skills, and have found wide acceptance among elementary school populations. These have their place as long as we don't have expectations of the package that are beyond those for which it was designed.

3.3 The Computer as the Assistant to Student Thinking - TUTEE

These programs allow students to map their thinking processes onto a computer model. Examples of these programs are Basic, LOGO, Pilot, Quill and Thinktank. All share some common characteristics. They are all aids to problem solving; some aspect of "programming" the computer is possible; a demand for a high level of skill development is implied; and the use of higher level thinking skills such as synthesis and evaluation is necessary.

What must be realized is that a great deal of time has to be spent developing the operational skills for any of these activities to be of benefit. It is essential that students have access to a lot of time on the computers. This is generally above the available time that a student is able to obtain in schools today. This may be why LOGO projects have not shown the results expected by teachers after they read the literature about LOGO. Most teachers are now planning specific lessons that integrate parts of LOGO into their instructional objectives. Teachers do this by either using part of the LOGO system or writing utility programs to get over the blocks.

Most of the work in this area has concentrated on the use of LOGO; however, some other powerful programs, such as Thinktank, are starting to accomplish some of the same objectives in different ways. The whole area of using a computer to stimulate student thinking deserves a great deal more thought.

3.4 Summary of present-day development

Two generalizations can be drawn from this evidence. More planning for computer use will take place in elementary schools. As software accesses the higher level cognitive skills it requires that more complex operational skills must be learned by the student (see figure 1). This has lead to a search on the part of educators for programs which:

- -match the curriculum
- -allow for a variety of learning styles
- -are cost effective
- -are easy to use but are not rejected if great benefit can be derived.

3.4.1 Figure 1

low op skills - CAI -drill and practice
- CML -increases operational skills for teachers
teachers- simulations - added commands
-expert systems
-word processors and databases
-authoring systems
high op skills -programming

4. CLASSROOM ORGANIZATION

Schools may take a variety of different approaches to organizing their computers. Basically, they decide to concentrate the computers in one spot or spread them out. By placing all, or some, onto mobile carts, combinations of these two approaches can be achieved. A variety of educational ramifications are apparent for each approach.

4.1 Lab organization

A lab can be defined as a location for the computers in which all of the students in a teaching group (usually a class) can be accommodated at one time. The teacher may choose to have more than one student on the computer at one time, up to about three per computer. More labs will contain from 10 to 30 computers, the larger labs being rare in school-based programs, although they are often in centralized facilities.

4.1.1 Advantages

This would be the ideal situation for every classroom if we could allow computers to sit idle. The lab allows all of the students to learn the operational skills together, and then when they progress to the educational use they could be at machines individually. The teacher can be dedicated to the computer activity or be doing something else with students not on the computer, allowing for flexibility.

With a lab in a school the computers can be run full time with some good scheduling. It also accommodates a computer specialist if one his hired for a school and generally provides a focal place for the computers.

4.1.2 Disadvantages

The biggest mistake made with this organization is that teachers do not spend time providing the students with adequate operational skills. The result of this is that students are continually coming to the teacher with requests to solve problems for them. The situation become very frustrating as the teacher flies from one computer to another solving problems as quickly as possible, often reducing the effectiveness of the learning.

There is sometimes a desire to ensure that every student in the school will have an opportunity to get onto the computers. This can be highly frustrating to teachers who do not want to use the machine at that time but feel that they must. Their comments will be things like "Oh no! It's Wednesday and I have to get something to do during my computer time." Other teachers do not get enough time to accomplish what they want, so they comment "I wish that I had another hour this week so that my students could finish their writing project." This can be easily solved by letting those teachers who are not prepared to use the computers have more time to prepare and let the keener go to it.

Sometimes the computers are not visible, so teacher will not use them. This is totally dependent upon the commitment that a school feels toward computers.

4.2 Classroom Computer Centre

A classroom computer centre will consist of relatively few computers (usually one to five), which will not accommodate an entire class but will allow students in that classroom to rotate throughout an activity.

4.2.1. Advantages

This is usually the preferred means for Division 1 teachers because they can more easily integrate computers into their centre or theme approaches. The computers are also very visible to the classes and a special room does not need to be allocated.

4.2.2 Disadvantages

Most often the teacher does not dedicate himself/herself to the computers. Usually he/she will be concerned with the bulk of the class which is not on computers. In this situation it is critical that the operational skills be well taught. If not, the students on the computers will be "bugging" the teacher to help them and the computers will quickly become a source of irritation to the teacher.

Very few teachers will utilize the computers 100% of the time in the classroom computer centre. This can be viewed as a waste of resource -- but name any other resource in a school that is utilized all the time. Agreed, rooms such as the gym are, but much of the physical education equipments sits idle for great periods of time.

4.3 Mobile Computers

Various combinations of the lab and classroom organizations can be accomplished by making some or all of the computers mobile. This is usually done using carts which have wheels and can be moved by upper elementary students. The disadvantage to this system is that it tends to increase the maintenance costs of the computer program. Proper training of the computer movers is essential.

5. FINANCIAL CONSIDERATIONS

I have observed that just as schools have gone through various stages of thought with respect to implementation, they have also gone through corresponding stages of spending money. There are three cost items to school and its staff with respect to computers. These variables are: hardware, software and staff development. In each of the following stages I will analyze the gist in terms development.

5.1 The Hardware Era

In the early hardware acquisition era a school will be solely concerned with getting on the bandwagon and measuring its success by the number of computer units it has been able to acquire. Computer "bargains" are very appealing. Very little software is acquired because all of the money is going into hardware and there is a prevailing belief that it is enough just to get machinery into a school. Staff development is non-existent. If it occurs at all, it usually consists of a computer store representative showing the staff how to boot a disk and explaining that all they need to do is follow a tutorial.

In the later stages of the hardware era some of the teachers realize that software and training are important. They go about making huge gains in these areas personally, but there is no overall school or system responsibility. Administrators have not yet realized the amount of money and human resources needed to achieve success.

Attitudes during this era are very diverse. For some teachers there is great enthusiasm and excitement. Seeing this excitement makes other people nervous, and there is concern about the computer taking over the teacher's role; that everyone is going to have to use the computers; and that teachers will have to become programmers.

5.2 The Software Era

This era is characterized by a school attempting to "get it together." Many diverse experiments and attempts have been made without coordination. Schools will do things like forming committees, designing curriculum, designing scope and sequence charts and establishing evaluation schemes for the acquisition of hardware and software.

Hardware acquisition continues to take place but by now the school district and the provincial education departments are taking a role in bulk purchases so the cost will be less. Schools will begin to purchase hardware based on the use of the machines: that is, what software they intend to purchase. Questions such as "Will this machine run this package?", are asked.

A wide variety of software is purchased in this stage. Teaches read the review in magazines and from other evaluators, hoping to locate the ultimate package for their students. Departments of education and school boards establish software evaluation committees hoping to provide their teachers with the best available software, influence publishers to provide just the right kind of software, and coordinate bulk purchases to reduce the costs.

A giant leap forward occurs during software acquisition to provide staff development in preservice and inservice education. Often someone is designated to do this job in a particular school district. Participation is on a voluntary basis. A wide variety of resources is provided from programming to specific software packages.

5.3 The Planning Era

During this stage school staff realize that the computer and its usefulness to them is based upon connecting the machinery and what it can do to the curriculum, and what it is that they are expected to do educationally.

Hardware is purchased with an end use consideration. An application is considered, usually by a committee, and the equipment purchased has to match the application.

The software purchased and often developed will tie into either the curriculum or textbook being used. Software can be previewed or borrowed by a school through a centralized pool if the material is infrequently used. Schools maintain their own software library for frequently used items.

Staff development becomes less centralized as schools plan for their own training based upon computer use. Appropriate staff development is required by a school system for those teachers working with computers. The exact training required is differentiated depending upon the role that a teacher will be expected to fulfill.

6. FUTURE TRENDS AND THEIR EFFECT

Computer education is so new that no agreed upon body of knowledge exists about what or how to teach using the technology. We have willingly opened our minds to the futurist hoping that a person who has been studying trends for the future can answer some questions that we have not allowed ourselves to take the time to answer. We have found ourselves believing that some of the following ideas are reality: Electronic mail; the cost of computers will drop endlessly; a new generation of microchips is just over the horizon: artificial intelligence, voice interface; expert systems: Telecommunications and robotics; these concepts are a reality for a very few human beings. They are not part of the general scheme in education.

To most teachers the advances in technology are so baffling that they are unable and unwilling to assimilate the changes into their day to day lives. Teachers are often left with the impression that the futurist is simply telling them " I know something you don't and you never will".

6.1 Example

An example of this kind of bind occurred when teachers of elementary students tried to get students to use an electronic mailbag system. The hope was that some interesting results would occur if students in various physical locations could communicate electronically. Hindrances to this scheme have, to date, remained unsolved. Electronic mail was designed for frequent adult users with few passwords and specific needs. The typical elementary school use is many children with a relatively large need for various forgettable passwords in many general situations. The operational skills required for electronic mail are great because of the interactions required between computer, modem and mail system. Also, the problem of a dedicated phone line for a large number of users is unsolved. The result is that electronic mail for the elementary student is rarely successful.

Likewise, many of the promises made by the futurists are unrealistic because they are dreamers who view computer technology academically. They present us with a POTENTIAL that is presently hindered by lack of a means to bring it to our students' level. Eventually, many of the futurists ideas will be implemented -- but not by many futurists.

6.2 The Computer Educators Role

The computer educator is the computer expert in education. These people have attained this position largely due to their own efforts. It is in their hands that the development of the futurists' ideas will occur. Unlike other fields of elementary education, everybody doing something with computers is new at it and nobody can tell anyone else exactly how it should be done. The best that can be accomplished by administrators and educational departments is to value the services of these people and to promote as much personal growth among them possible.

COMPUTERS IN SCHOOLS

STRATEGIC PLANNING NEWSLETTER

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The purpose of this newsletter is to provide instructional leaders with help in understanding and answering the strategic computer-related questions they face. This article lists some of the most important questions. (Some of these questions were addressed in the first issue of this newsletter, while others will be addressed in the current and future issues.)

It should be understood that strategic decisions need to be periodically re-examined. Major changes in technology may require corresponding major changes in strategic planning. A school district's goals may change, requiring new strategic planning. There may be major changes in the fiscal situation. (Future issues of the newsletter will contain updates to previously-considered question and answers. These will reflect changes in technology and will represent the best current thinking on appropriate instructional uses of computers.)

Some Typical Computer Questions

Most instructional leaders have their own set of questions that they feel need to be answered to support strategic planning. The list given below is not intended to be comprehensive, but to give a solid overview of the types of questions to be addressed in the newsletter:

1. What are the overall goals or guiding principles for instructional use of computers? How will accomplishing these goals improve our schools? (These questions were addressed in Volume 1 Number 1 of this newsletter.)

2. What are the major future trends in hardware that will affect strategic planning? For example, will computers decrease substantially in price, and will voice input suitable for use by students become inexpensively available? (Addressed in this issue of the newsletter.)

3. How will computers affect the teaching, learning, and importance of basic skills? For example, if all students have calculators, will we continue to place the same emphasis on basic paper-and-pencil computational skills?

4. What are the major trends in applications software (for example, word processor, database, graphics, spreadsheet, telecommunications)? What computer applications should students learn, at what grade levels, and how should this affect the contents of the current curriculum?

5. What are the major trends in computer-assisted instruction (CAI)? How will continued improvements in cost effectiveness of CAI affect schools? What is intelligent computer-assisted instruction (ICAI) and how will it affect education? Will CAI or ICAI cause major changes in the role of teachers in education?

6. What type and how much teacher training is needed? Who should carry out this teacher training? When? What will it cost? What can school districts do to encourage teacher training institutions to place increased emphasis on preparing their graduates to work with computers? How can an administrator evaluate the computer-related performance and knowledge of teachers?

7. How will increased availability of computers affect the teaching of problem solving or the ability of students to solve problems? Are computers mainly of use in math problem solving, or are they of use in solving problems throughout the curriculum? How can the availability of computers be used to increase a school's emphasis on problem solving?

8. How are computers changing the way we access and use information? How should continuing improvements in access to more and more information affect our curriculum? How should computers be used in the school library? Should a school have access to online databases? How should the laser disc database systems that run on microcomputers affect schools?

9. What software is needed, and how much software is needed? How can one get good software? Where should a school's or district's software be housed, and who should be in charge of it? How should a school district handle software piracy?

10. What hardware, and how much hardware, is needed? Should it be networked? Should it all be the same, or is it better to have students learn to use a variety of computer systems? Can portable computers, which students carry around much as they carry their books, be used effectively in a school setting?

11. Do all students need to learn keyboarding? If so, how well, at what grade level, who should teach it, and how long will it take? (Do all teachers need to know keyboarding and word processing?) Will the learning of keyboarding cause a decrease in handwriting skills?

12. Should a school district work to achieve computer literacy for all students through a specific required course, or should this be done through integration of computer-related instruction into a large number of courses?

13. Which students need to learn how to write computer programs? What languages should be taught? Will these same languages still be suitable in five or ten years?

14. What specific teacher preparation is necessary to be a teacher of computer science or computer literacy? Should there be credentialing requirements? How should schools handle the "grandparenting" problem? Is the teaching of computer science or computer literacy by teachers who have limited computer backgrounds doing more harm than good?

15. What changes in curriculum content will be necessary because of progress in artificial intelligence. If a computer can solve or help solve a general category of problem that is currently studied in our schools, what do we want students to learn to do mentally, using pencil and paper or other conventional aids, and using a computer?

16. Should computer dollars be allocated equally on a per student basis among the elementary, middle (or junior high) and high schools in a district, or how should the funds be distributed? Should special allocations of computer resources be made for students in gifted and talented programs or students in special education?

17. What should the district do to address computer-related equity issues? Computer-related equity questions have arisen in areas such as sex, race, wealth, etc.

18. If a school has a minimum number of computers (such as one per 20 to 40 students) should they be placed in a computer lab, spread among the classrooms, or how should they be distributed? As the number of computers continues to grow, where should they be placed? In an elementary school, is it better to place computers into every classroom, or to concentrate them in computer labs and in the library-media center?

19. Does the district need a computer coordinator? Do individual schools need computer coordinators or computer representatives with release time to perform building-level computer-related leadership activities and to supervise computer labs? What qualifications should such personnel meet? In elementary schools, is it appropriate and/or successful to assign the library-media specialists the responsibilities of also being computer coordinator?

20. How can a school district take maximum advantage of the fact that many students and teachers have computer access in their homes? Should the school district provide "loaners" for use by students, teachers, or parents? Should the school district loan software to students for use at home? If software is loaned to students for use at home, how can illegal copying be prevented?

It is evident that this list could easily be extended. Have you and other instructional leaders in your district raised all of these questions? Are you confident about your answers? If your answer to either of these questions is "no" then you will want to become a regular reader of this newsletter.

NOTES

ADD TO THE LIST OF
STRATEGIC QUESTIONS

The Foundations for Strategic Planning: Educational Principles and Computers-instruction goals

It is assumed that you readers of this newsletter help make major strategic (that is, long term) decisions on how computers will be used in your schools. These decisions should support the overriding educational principles held by you and your school district. They should also support the computer-related goals your district has established.

The decisions you help make will involve expenditures of substantial sums of money for acquisition of computer hardware, software, instructional materials, teacher training, classroom renovation and curriculum planning. Moreover,, each decision has quite long term impact on your school system. For example, a microcomputer may have a life expectancy of eight to ten years in a school environment. Software, instructional materials, teacher training, classroom renovation, and curriculum planning all have a relatively long life expectancy. You must make good strategic decisions in these areas!

You may find it rather frightening to be expected to make good strategic decisions in computer-related areas, since it is likely that you have little formal training and experience with computers. Also, you know that computers are a very rapidly changing area of technology. Even experts, who devote full-time to studying instructional uses of computers, feel overwhelmed by how fast things are changing.

Don't despair. You can learn to make good strategic computer-related decisions. By far the most important thing to remember is that you are a well educated, competent, professional educator. If you build on the common sense and skills that have gotten you to your current position, you can easily learn to make appropriate computers-in-instruction strategic decisions.

This article will get you started. It reviews basic educational principles that are as applicable to computers-in-instruction as they are to all other major educational decisions. It then gives some overriding goals for computers in instruction. Such goals provide a framework for making appropriate strategic decisions.

Educational Principles

Given below is a representative set of educational principles. Computer-related decisions should be rooted in the educational principles you and your school district follow in other long-term planning. The educational principles used by you and your school district may include some or all of these, plus others.

1. Schools should help all students to achieve their full potential.

2. Schools should help all students to gain a functional level of basic skills in reading, writing, arithmetic, speaking, and listening.

3. Schools should preserve and support the historical, cultural, and values orientation of the community and nation.

4. Schools should help all students to improve their higher-order and problem-solving skills.

5. Schools should help prepare all students for a productive and satisfying adult life in our rapidly changing society.

Develop your own set of principles and think about how they relate to possible uses of computers. It may be that some of your educational principles are supportive of use of high technology, while others oppose the changes that use of technology may bring. For example, will use of computers improve basic skills, or result in a decrease in basic skills and more dependence on machines? Do the historical and cultural goals in your school district restrict use of technology in instruction?

An Example

When a question of instructional use of computers arises, do a rapid mental check against your list of principles. For example, suppose that your district Special Education teachers come to you and ask for money to buy computer hardware and software. The computer systems are to be used to provide slow learners with extra drill and practice help in arithmetic. The Special Education teachers present the argument that there is sold research evidence that learning disabled students will learn faster using computers, and therefore are more apt to keep up with their grade level. They cite educational research to support their assertion.

To get started, determine if you are being asked to make a strategic (long-term) decision. Do the Special Education teachers want to run a small short-term experiment or do they want a district-wide long-term commitment to such instructional use of computers? Suppose the latter is the case.

Then a good way to proceed is to do a quick mental check of a list of overriding educational principles. You will likely conclude that the proposed use of computers is consistent with and supportive of principles 1 and 2.

You might raise the question of whether more drill and practice on basic arithmetic skills will contribute to achieving principles 4 or 5. There has been considerable educational literature in recent years suggesting we have overemphasized "basics" and that we would be better served by increased emphasis on higher-order skills and problem solving. What evidence do the Special Education teachers have that increased emphasis on basic skills will improve higher-order and problem-solving skills, or better prepare their students for a productive and satisfying adult life in our rapidly changing society? Might the requested resources better be spent working directly on principles 4 and 5?

Next, raise the question about alternate use of the financial resources to attack the same educational problem. There is nothing magical about computers and other high technology. Computers are merely tools that can be used to attack certain problems. For any educational problem there are likely to be a number of valid approaches. Could the problem be approached by use of more or different print materials, by obtaining more parent-volunteer help, by hiring an aide, by making use of student volunteers, etc? Cost-effectiveness is always a valid question.

Notice that you do not need to be an expert in special education or in instructional use of computers to raise these questions. You are a professional educator and a leader. You are in a decision-making position. Your decisions will be better and more consistent if they are based on a consistently-applied set of educational principles.

Your Knowledge of Computer Technology

Actually, whether you realize it or not, you know quite a bit about computer technology and its applicability to education. For example, chances are that you own a calculator and use it fairly regularly. Thus, you know that an inexpensive, hand-held calculator can perform the operations of addition, subtraction, multiplication and division on whole numbers and decimal fractions. You may be aware that good quality, hand-held, solar battery powered calculators are often sold at a retail price of under $5 U. S.

When considering the request of the Special Education teachers you could raise the question of shy not provide each student with a calculator? A modest amount of calculator practice will produce skills in the four basic arithmetic operations that may well exceed the paper and pencil skills students require hundreds of hours to achieve.

Notice in the calculator discussion how some practical and low-level technical knowledge is useful. You have this practical and technical knowledge about calculators, so you know enough to raise the question of possible calculator use. It is a profound question -- challenging to the best mathematics education leaders! Notice that you do not need to be a mathematician and you do not need to know the underlying theory and construction of calculators to raise the question.

Some school administrators have substantial computer knowledge, while others have had no formal training or hands-on-experience. Even without such experience, all school administrators have seen workers and students use computers. All are aware of computer applications in business, industry, and government. Such knowledge provides a useful background for strategic planning.

Computer-Related Goals or Principles

Being able to raise the above-mentioned sorts of questions and issues does not solve the problem of how you deal with the Special Education teacher's specific request for computer funds. Of course, the request may be withdrawn because the Special Education teachers have not given sufficient thought to the questions. But many groups of teachers will be making similar requests for computer funds. Thus, you also need a set of computer-related goals or guiding principles for your school district.

Listed below are a representative set of computer-related goals or guiding principles. As with the educational principles, you and your district should have a set of goals that fit the needs of your school district and community. Such goals provide a foundation for computer-related strategic planning.

1. All students should become functionally computer literate. This means they should learn to use computers as a general-purpose tool and develop a good understanding of how computers are involved in our changing society.

2. Computer-assisted instruction should be used when (and only when) it is both educationally and economically sound.

3. The curriculum content in all disciplines and at all grade levels should appropriately and adequately reflect the capabilities and limitations of computer-as-tool.

4. Consistent with the overall educational principles and financial resources of the school district, computer-related programs of study should be made available to the following groups of students:

    a. Students wanting to learn computer programming and computer science (perhaps for college-prep purposes).

    b. Students who want to learn vocationally-oriented computer applications in such diverse areas as industrial arts and business.

    c. Students preparing to be homemakers.

You will certainly want to have your computer committee involved in developing such a set of goals. (You do have a computer committee, don't you? Such a committee should include computer technical expertise and representatives of the various groups involved in implementing a district's long term computer-related goals. It can be quite helpful to have some computer-oriented representatives from business and industry on the committee.)

It should be evident that each of these computer-related goals needs careful definition and further refinement to provide more specific details. That is an appropriate task for the computer committee. But even at this level of detail, such a set of goals can be quite useful in strategic planning.

Notice how goal 2 relates to the Special Education question of the previous section. Computer-assisted instruction (which includes computerized drill and practice) must prove itself on a cost-effectiveness basis. Of course, you know that the cost per pupil is much higher in Special Education than it is in regular education. Thus, all other things being equal, computer-assisted instruction will be used in Special Education before it is used in regular education.

It is important that you examine your school district's computer-related goals to see if they are consistent with the district's overriding educational principles. Inconsistencies can lead to major strategic planning problems. One simple example illustrates some of the difficulties. We indicated that a possible response to the computers-in-special education request was to suggest use of calculators. But most parents learned to do paper and pencil arithmetic; many feel that it is "good" for their children to gain these same skills. This provides an example of an historical, cultural, values issue. Strong emotional arguments may override any logical arguments in deciding whether to substitute calculators for part of the instruction in paper and pencil computations. Fortunately, you, as an established educational leader, are already experienced in dealing with such problems.

Goal #1, universal functional computer literacy, is both widely agreed on and quite controversial. The issue is how to achieve universal functional computer literacy. A number of states have mandated computer literacy and implemented their mandate through a required computer literacy course. An alternative approach is through integration of computer instruction and computer usage into a large number of courses (for example, as is suggested in Goal #3). Possible ways to achieve universal computer literacy is one of the Strategic Questions to be addressed in a future issue of this newsletter.

Goal #3, the integration of computer-as-tool into all disciplines and grade levels, actually expresses a fundamental strategic decision Is this goal appropriate to your school district? It is a challenging goal appropriate to your school district? It is a challenging goal to an educational system, since it will require substantial curriculum revision, lots of computer equipment, and substantial teacher training. We will address these topics in a future issue of this newsletter.

Practice What You Have Learned

Educational principles and computer-related goals provide a foundation for strategic planning. Think about several strategic decisions you and/or your school district have already made. For example, have you decided that all teachers need to learn to use computers, or that computer instruction is to be handled by a small number of computer specialists in each school building? Are all students learning about computers, or is computing mainly available through computer programming courses taught by math and business teachers?

After you have identified several strategic decisions you have already made, re-examine them in view of your underlying educational principles and computer-related goals. Are you confident that you have made good decisions?

THE FUTURE OF COMPUTERS IN EDUCATION

If you knew the future, you could be an excellent strategic planner. But the future is not easy to predict. Futurists has a poor record of predicting major inventions and major social trends. An early futurist in the computer field suggested that the entire world's demand for computers could be met by a dozen or so machines. Moreover, the futurist argued computers used so much electricity that this would prohibit a large computer market from ever developing.

This futurist failed to predict the transistor, the integrated circuit, and large scale integrated circuit, the large scale integrated circuit, and today's super chips. A single super chip now does the work of a half million vacuum tubes, but uses less power and costs about the same as one vacuum tube. Such progress in transistor technology has made possible digital watches, hand-held calculators, and computers inexpensive enough so that many millions are purchased every year.

This article attempts to predict the future of computers-in-education era the next ten to twenty years. It includes a small number of predictions and explains the basis for each prediction. There is no guarantee that these predictions will prove to be accurate. However, the predictions are based on trends that are already established and technology that has already been invented. Thus, I believe that the predictions will be accurate enough to serve as a good basis for strategic planning.

We Live in an Information Age

A number of futurists have written books identifying major trends of change occurring in our society. Two of the best known books are The Third Save by Alvin Toffler and Megatrends by John Naisbitt. Both books are based on well established trends and do not assume major breakthroughs in technology.

Toffler, Naisbitt, and others express general agreement on the idea that a sequence of eras can be used to describe our changing society:

1. Hunter-gatherer era.
2. Agricultural era.
3. Industrial era.
4. Information era.

Each era poises certain challenges to a society's educational systems. Education for life in a hunter-gather society is mainly "learn by doing." A child sees older children and adults carrying on tasks that are necessary to survival. The child receives instruction from people engaged in these tasks. The child immediately applies this instruction, receiving feedback on how well the task is being accomplished.

The agricultural era began in various parts of the world perhaps ten thousand years ago. With it came growth in village populations and increased time for some people to become repositories of knowledge. Slowly the foundations of reading, writing, and arithmetic were developed. Such knowledge was necessary to the survival of the society. Often it was reserved for a priesthood, since knowledge represented power.

But it takes many years of formal training and experience to develop useful levels of skill in reading, writing and arithmetic. Thus, formal education and a class of professional educators arose. These represented a major change in educational systems.

Such training in the three R's led to a significant change in the way humans process intellectual information. As a professional educator, you are likely familiar with Piaget's educational development theory. The high end of his scale is formal operations. Some students have not yet achieved the formal operations developmental level even by the time they enter college. But research evidence suggests that essentially no one achieves this developmental level in a preliterate society! That is, reading and writing allow and foster a higher developmental level than naturally occurs for people living in an illiterate society!

Will ready access to computers, along with an education that incorporates computers as an everyday tool, foster a still higher developmental level? The first hints of this are beginning to appear. Evidence to support such a conjecture will be presented in a future issue of this newsletter.

At the time of the American Revolutionary War (1776-1783) about 90 percent of the work force in that country was involved in agricultural production. A mere two hundred years later in the United States this figure had been reduced to about three percent! The agricultural era had long since ended.

The industrial era is often characterized by a massive shift from farm production to factory production, with use of steam, water and other types of power to increase productivity. An industrial era both requires and supports large cities. It is important to realize that the need for farm goods did not decrease. It was improvements in farm productivity, storage and distribution, that made possible the mass exodus from the farm.

Various writers have attempted to characterize what constitutes an appropriate education for an industrial era society. Mass literacy is helpful, as is punctuality and willingness to follow directions. Most of us received our education in an industrial era educational system. We need only introspect (or look at our current system) to learn about an industrial era educational system.

But in the United States the industrial era ended a couple of decades ago. The shift was to a service and information society, which was named the information era. Currently less than 12 percent of the U. S. labour force is employed in factory production. Factories are now highly capital intensive and increasingly automated.

As with the decline of the agricultural era, the demand for factory goods has not decreased. Instead, there has been steady gain in factory productivity and in methods for the storage, transportation, and distribution of factory goods.

Improvements in storage, transportation, and distribution have done more than lead us out of both the agricultural and industrial eras. They have combined with improvements in communication to create a world economy. In every case where labor represents a significant fraction of the cost of manufactured goods, the world market can be seen. It is far cheaper to build a car in Japan or South Korea and transport it to the United States than it is to build it in the United States, shipped abroad for processing into clothing, and the finished goods are returned to the United States for sale.

It is evident that continued improvements in communication and in the processing of information are important aspects of the information era. We are rapidly approaching the time when every student can have easy access to the contents of a multi-million volume library along with access to several thousand major databanks that are regularly updated! Such access can be possible to people throughout the world.

But it is not so obvious what constitutes a good education for life in an information age society. That makes strategic planning for educational change particularly difficult.

The next section makes several predictions for the future of computers in instruction. The last section of this article suggests strategic educational decisions that one might make based on these predictions.

The Future

In this section we give six major predictions that can serve as a basis for strategic planning in education. A brief rationale for each prediction is also provided. Note that all predictions are made assuming that massive war or natural catastrophe do not markedly change current scientific, technical and societal directions.

Prediction #1

Computer hardware will continue its rapid improvement in price to performance ratio.

This prediction is a certainty. Research laboratory products are generally about five years ahead of the current commercial market. Roughly speaking, these labs are now experimenting with super chips that represent an improvement gain of a factory of 16 over current commercially available chips. Moreover, there is no sign that such rapid progress is decreasing. Thus, we know that super chips will become commercially available that are many times more powerful than current chips.

One way to represent this progress is to make a conjecture about children's toys twenty years from now. It seems highly likely that there will be many toys (retailing at under $50 in current dollars) containing at least ten times the computer power of the best personal microcomputers currently being used in our schools! Such toys will contain perhaps 100 times the compute power of the computers currently most widely used in our schools.

A different way to view the hardware progress is to predict that eventually nearly every student will have excellent all day, every day access to very powerful computers both at school and at home. Within fifteen years there will be many schools in which every student has a computer. (In many schools these will be portable units that students can carry home.)

Some of the strategic implications of Prediction #1 are clear. Schools must cope with the fact that computers will become cheaper, more powerful, and more readily available. Hardware will continue to change rapidly for the foreseeable future.

Prediction #2

Software progress will continue to be both rapid and cummulative.

It is software, not hardware, that drives the computer field. Software progress has been steady, as fundamental tools and theory have been developed. It is becoming increasingly easy for software developers to build upon the previous work and ideas of other software developers.

Consider, for example, the very best "integrated" packages of software. They may combine such applications as word processing, database, spreadsheet, graphics, and telecommunications. Such products have already been on the market for several years. Some computer hardware manufacturers are including a good variety of applications software (free or at moderate cost) with their hardware. This is an inevitable trend. That is, the cost of a good collection of software application tools will decline rapidly. While "new and better" ones will continue to come to market on a regular basis, some of the ones currently available are very good.

Two other aspects of software progress are important. First, consider computer-assisted instruction. Several well established companies currently offer a wide range of software covering significant parts of the K-12 curriculum. A number of other companies offer software covering smaller pieces of the curriculum. Each company builds on its current software, both improving current software and adding new curricular areas. Eventually there will be good CAI software covering the entire K-12 curriculum.

Second, consider software incorporating ideas from artificial intelligence. Such software is now commercially viable in a rapidly increasing number of applications. It is inevitable that education-oriented software will gradually grow in "intelligence: and that artificial intelligence will have a major impact on education. This area will be discussed in detail in a future issue of this newsletter. The key question is simple to state but difficult to answer. If a computer can solve or help solve a major category of problems that students study in school, what should students learn to do mentally, assisted by paper and pencil or other "conventional" aids, and assisted by computers?

As with hardware, several strategic implications of Prediction #2 seem clear. The software evaluation and selection problem will not go away. Some of the newer software being developed will be far superior to existing software. Computer-assisted instruction will gradually grow in importance and will challenge many parts of our conventional instructional delivery system. Artificial intelligence will eventually have a major impact on education, but this will be slow to happen at the precollege level.

Prediction #3

Textbooks will continue to be a dominant influence in curriculum, and much software will be tied to the standard textbook series.

To a very large extent, our curriculum is textbook drive. Thus, a relatively few major publishers play a dominant role in determining our curriculum. Most of these publishers are now also involved in the development and marketing of educational software. They have discovered that such development and marketing of educational software is highly unprofitable unless it ties in closely with their existing print materials.

Many school systems will find that adopting standard textbook series that tie computer usage directly to the textbooks will be easier than any more innovative approach to computer usage. Consequently, major curriculum change fostered by computer capabilities will be slow to come.

Prediction #3 suggests that school districts that want to be at the forefront in making effective use of computer technology face a particular challenge. Much of the software they will want to use is not closely tried to existing textbook series and existing curriculum. Use of such software requires a higher level of teacher training and curriculum than does use of more conventional software.

Prediction #4

While the pressures for curriculum change to reflect computer capabilities will be large, actual changes in curriculum content will be slow.

An excellent example is provided by the arithmetic and mathematics curriculum. For years our leading mathematics educators have recommended major use of calculators and computers, and that the curriculum content change to reflect capabilities of these tools. But almost no change has occurred. There is immense inertia built into our current teacher knowledge and abilities, our current textbooks and curriculum, and our testing system.

A strategic implication of Prediction #4 is that there will be a growing displeasure with our schools on the part of educated people who have come to understand the power of computers and what constitutes an appropriate education for life in an information age society. This displeasure may manifest itself in increased enrollment in private schools and in home schooling. It will certainly be reflected in increased public criticism of schools.

Prediction #5

Our current school systems will face increased competition, with computers playing an important role in the competition.

Likely you have seen ads for software that is guaranteed to raise student performance on SAT or other tests by a significant amount. You may have seen ads from major CAI companies suggesting increases in learning rates of fifty percent or more. Perhaps you have heard radio ads or seen television ads for "store front" study centers that offer computer-based instruction.

The strategic implications of Prediction #5 are best understood by taking into consideration Predictions #2 and #4. We will have more and more evidence to support the effectiveness of CAI. Also, CAI will make possible a broader curriculum (allowing courses with very low student demand). The content of traditional courses that ignore computer use will seem more and more inappropriate to adults who use computers on an everyday basis. There will be a trend toward high-tech schools (both public and private) and there will be increasing numbers of non-traditional instruction situations that make massive use of computer technology.

Prediction #6

The most exciting curriculum changes may first occur in the elementary schools.

The resistance to educational change seems to vary inversely with grade level. This means that research universities have the greatest resistance, followed by four year colleges, then community colleges, and so on. Elementary schools are most open to change.

One change that seems inevitable is that eventually all elementary school students will learn process writing in a word processing environment. The hardware and software they use will include both a spelling and a grammar checker; this will lead to significant changes in the spelling and grammar curriculum. Eventually these student computer systems will be sophisticated information retrieval systems, giving access to large libraries of information. This will lead to changes in how we teach access to and use of information.

Prediction #6 suggests that elementary and middle schools are most open to the types of educational changes that are needed for an information age society. Of course, change at these grade levels will eventually require change in the upper grades.

Recommended Strategic Decisions

There is a trite phrase that aptly describes the computers-in-education field. Computers are here to stay. This means that strategic decisions you make and begin to implement now will have very long-term impact on your school system. Three major strategic decisions are recommended and briefly discussed.

Strategic Recommendation #1

Hardware and software acquisition and maintenance should become a regular part of the budget.

Very few school districts have made a permanent commitment of ongoing general school district funds for hardware and software. Instead, the approach has to been to use non-reoccuring funds, money raised by parent teacher organizations, money from grants, etc. to provide a temporary fix.

A school district should determine an initial level of permanent funding for hardware and software. Even a figure as low as one-half of one percent of the school budget is a significant commitment. However, this is woefully inadequate to the long term changes we envision. Thus, either the initial commitment should be substantially larger or the district should begin planning for substantially increasing the figure in future years.

Suppose, for example, that eventually a school system provides an average of $700 (U.S.) worth of computer hardware and software per student. It will likely take about this much computer facility to provide all students with easy-at-school and at-home access. (Here we are looking at least ten years or more into the future, we are assuming Prediction #1 will prove to be correct and we are using 2986 US dollars.) Suppose further that the prorated cost of such hardware is $120 per student per year. This means that a typical school system will need to devote about four percent of its entire budget just for hardware and software. This level of funding could be reached by starting at the one-half percent level and adding that much more each year for seven years.

Strategic Recommendation #2

Computer-related teacher training should become a regular and significant ongoing district commitment.

It is hard to appreciate the magnitude of the teacher training problem. We will address it in more detail in a future issue of the newsletter. Roughly speaking, one can make a good analogy with the development of reading and writing. Suppose that none of your teachers knew how to read and write, and that reading and writing had just been invented. How much inservice education would be required to allow our current educational system to exist?

It should be clear that we are talking about a major change in how we view inservice education and the teacher's commitment to lifelong learning. We face a long period of very rapid curriculum change. Both the content and pedagogy of education will change at unprecedented rates.

Incidentally, your new-hire policy should give strong weight to computer competency. You should not accept recent college graduates who are computer illiterate. Communicate your thoughts on this matter to your local teacher training institutions.

Strategic Recommendation #3

You should establish a curriculum revision framework that facilitates major changes in curriculum content across all grade levels and curriculum areas.

Previously we mentioned process writing in a word processing environment, with access to spelling and grammar checkers, as well as computerized information retrieval. Suppose that students begin their formal instruction in use of such a system in the third grade. Then they will need to continue to receive instruction on such a system throughout the remainder of their schooling. All teachers at the third grade and higher levels will need to work with students who expect to use such a computer system to do almost all of their writing and much of their information retrieval.

A similar set of comments hold for instruction in arithmetic and mathematics. Eventually, starting at very early grade levels, students will have access to computers that are more powerful and user friendly than the best of today's microcomputers. This will require substantial revision of the entire mathematics curriculum. Also, students make use of their mathematics knowledge in other courses. This means that the curriculum in every class that uses or could make use of student mathematical knowledge faces revision.

The main conclusion is that the impact of computers on our educational system is just beginning. These are exciting and challenging times!

ADMINISTRATIVE USES OF COMPUTERS

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I. INTRODUCTION

Any strategic planning must by its nature be concerned with future issues. The use of computers in administration is wide and varied. The term "administrative uses" refers to the three areas of administrative computing (central office), school office administrative uses and administrative concerns about the classroom uses of computers. Historically the large boards: Edmonton and Calgary Public and Separate got into computing to do the traditional data processing problems of payroll, general ledger, student marks and scheduling.

These jurisdictions grew up around the traditional main-frame vendors of IBM (Edmonton Public & Separate), Digital (Calgary Public), and Sperry (Univac-Calgary Separate). As the cost of computer equipment continued to decline, other jurisdictions could afford to step in and did so, usually with a time-sharing computer of the mini to mainframe size. Less traditional companies such as Burroughs and NCR became well established in these arenas.

Time, continuing to wait for no man, saw further reductions in the cost of computing and, with the infusion of money via BQRP and other sources, saw many other schools and school jurisdictions step into computing to meet the constantly increasing demands for information in the work place. To the already diverse collection of computing hardware was added the instructional and administrative computer hardware of Radic Shack, IBM PC's, Commodore (64's, VIC 20's, PC 10's, Amigas...), Apple II+, IIe enhanced, Macs (both 'thin' and 'fat), the odd Lisa, Altos, Sperry, Olivetti. Many of the instructional computers found their way into administrative uses of various kinds.

To this potpourri of hardware came an equally diverse set of software for administrative use: home grown systems, consultant built systems, off the shelf 'turn key' systems, various stand alone non-integrated packages, vendor supplied systems, and so on! There exist many student packages running on a wide variety of computers that use various operating systems. Not only does this make the sharing of information between school administrators difficult, quite often the differences are so great that there is little point in administrators even talking with each other.

To this highly fragmented environment add the co-variants of "the further you are from a large center, the more difficult becomes the maintenance" and the cost of remote data communication often further reduces the likelihood of jurisdictions communicating with each other in a meaningful way.

It is important for any strategic planning process to recognize the extent of the diversity of hardware and software in the province, in order to examine the issues of the future in some meaningful way.

II. THE ISSUES

There are many ways that the problems confronting educators may be examined. For the purposes of this symposium they will be broken down into the categories of:

A. Hardware maintenance
B. Hardware enhancements
C. Software acquisition and enhancements and
D. Emergent issues

Each of these will be presented with the intent of clarifying "What is?", "What can be done to improve what is? and "What is likely to be in the future?".

A. Hardware Maintenance

Most mainframe and minis are maintained under contract with the vendor of the equipment. Only in the realm of the stand-alone word processors and micro computers is it even feasible for jurisdictions to consider reducing costs by performing one's own maintenance. APPLE has demonstrated a commitment to the education market by allowing education institutions to become what is referred to as a LEVEL I dealer.

Mechanical components of micros (disk drives, printers, keyboards, etc) are prone to wear out, break down, or malfunction. The normal computer owner must take the unit into an authorized dealer, leave it for some length of time, and pick it up -- hopefully fixed! For home computers such an arrangement may be acceptable and may even be to some classrooms. Clearly, it is not acceptable for school offices or central office environments.

Under a Level I agreement, the school jurisdiction agrees to pay to have a person trained in hardware and further agrees to carry a specified amount of inventory. For the fee, the jurisdiction obtains a set of manuals as well as the diagnostic hardware and software for determining hardware problems. A whole disk drive may be 'swapped' for a new one (at, say, 10% under wholesale) or just the analog card on the drive may be swapped if that is the problem. Swapping takes place at the **board** level and not at the **chip** level.

Since the machines currently in place will continue to grow older, the cost of keeping them running both in real dollars as well as in 'down time' will increasingly be an issue. Boards, having layed out capital money for equipment and further money for software, are going to want to reduce the ongoing costs in this area. Is there room for a CHIP LEVEL (Level 2) at a central place such as Alberta Education or the University of Alberta or the University of Calgary.

Where are other vendors such as IBM on the issue of education maintenance of equipment? To this point in time they have only supplied a partial list (attached) of some equipment that can be exchanged. Careful scrutiny of the prices will quickly demonstrate that the parts can usually be purchased cheaper elsewhere and that the list does not cover all of the equipment that a school jurisdiction will be maintaining.

Other issues for discussion:

- How can administrators get training in order that they can better represent their own concerns?
- How can training institutions such as universities get better set up to meet the new emerging needs of technology in education?
- Inside an IBM may be any of 4-5 different types of disk drives; within an APPLE IIe may be many different keyboard decoders. What happens as this equipment becomes older and parts harder to obtain? What strategy covers replacement and under what rules?

B. Hardware Enhancements

Hardware has evolved and will continue to change. The 32K IBM 1500 in the old education building; the early 8" floppy disk drives of the stand-alone wordprocessors; the single-sided single-density 5 1/4" Apple drives; the single-sided Mac drives; the early Centronics printers verses the printers on the market now -- all illustrate that technology continues to change and improve.

Some of the changes coming may terminate existing lines or cause administrators to rethink some of their 3-year plans. Imagine:

-just installing a class of Macs and then hear the announcement for the MacPlus!
-buying a 'skinny' Mac and the 'fat' one is announced.
-buying PCjrs and then they are no longer made.
-buying IIe's and finding out they should be enhanced.
-buying a LISA - renamed for the Mac family, and then dropped alongside the Apple III.
-buying an IBM AT and finding the differences in the 1.2M floppy; not all software runs the same as the PC/XT, etc/
-installing the PC Network (or Janet, Novell, Appletalk, etc.), and IBM announces the Token Ring network.
-buying IIe's with disks,, and the 3 1/2" becomes the new standard.

Many do not have to imagine the above since some of the charges have already taken place. The rule is that technology will continue to change. The central issue is: **How can educators plan for technology change**?

Other Issues:

What about totally new machines like Digital's micro VAX II (with a VAX 780 on a chip)?

-the soon to be announced IBM with the 80386?
-are the 2400 baud modems for real?
-what printer technology do you step into and when?

C. Software Acquisitions and Enhancements

Everyone who has used a computer and has written a program themselves will know that there are always improvements being done. Software is not a static entity but is constantly being updated with new features, bug fixes, legislated changes, and so on. Educating senior decision-makers and elected officials that this is true is an important task in itself.

Pretend for a moment that you have a micro with a hard drive. Further assume that a new version of the operating system comes out that requires the user to reformat the disk. A casual user would probably use a 'backup' command that may be incompatible with the 'restore' of the new version. Old software that "used to work" on the old version may no longer work or have subtle changes in its performance.

Not only must a jurisdiction acknowledge that selected software must be maintained at a current level, it must have people capable of installing it (or be left at the mercy of the consultants!) and must budget for this fact of life ahead of time. For illustration, consider the following simple example:

One class of 30 IBM PC's. When purchased, these machines were acquired with DOS 2.1.

DOS 3.0 is released, and the jurisdiction decides to upgrade (the number before the decimal changed - a good reason most of the time!).

Cost: $40.00 each x 30 machines = $1,200.00 (not including labour!)

If the class was running LOTUS 1-2-3 the unit cost would be $US 150.00 for a class cost of 30 x 150 x 1.40 (exchange) = $6,300.00.

There are many software packages -- Miliken math, dBASE III, Word Perfect, MultiPlan, Displaywrite III, etc., that may be upgraded to "current" releases. Software budgets must be built to cover this eventuality.

Other issues:

-Can school jurisdictions continue to "go it alone" on all fronts at the risk of losing provincial buying power?
-How can symposium delegates contribute to the site/system license challenge?
-What are the problems involved with copy protected software in the administrative environment?

-Who should set administrative software standards (e.g. the emergent communications software for the Alberta Education messaging system, school marks reporting to the Department, annual financial reports, etc.)?

D. Emergent Issues "The times they are a changing."

-Should Alberta Education show leadership in standardizing hardware and software for administrative use? What are the benefits and what are the risks?

-What are the current crop of teachers teaching computer literacy going to do when all of the students coming into the class already know more than they do?

-What are the students transferring into the school and who are computer illiterate, going to do in a literate school?

-Students use Brand X in School #1 and move to School #2 where Brand B is used. Administrators move from School #1 to School #2.

-Who is responsible for the backup of data on all of the hard drives?

-What will the current crop of computer graduates from our schools do in society if they are taught computing without any moral/ethic framework for its use?

-What will new technologies like the Compact Disk (CD) player **really** have on education?

-What is happening in computers in society, such as electronic fund transfer (EFT), banking, debit cards, and so on. What should be the educator's response?

-Who owns software developed on publicly funded machines? What policies should be in place?

-What should be the response of the APPLE direct move to designate dealers?

-What steps can be taken to keep educators in technology together?

-How much is enough?

ADMINISTRATIVE COMPUTER QUESTIONNAIRE

PARTICIPATING JURISDICTIONS

JURISDICTION	POPULATION
Pincher Creek School Division No. 29	1,225
Stettler School District No. 1475	1,300
County of Athabasca No. 12	1,882
County of Wetaskiwin No. 10	2,000
County of Wheatland No. 16	2,200
Lethbridge Catholic Separate School District No. 9	2,300
Brooks School District No. 2092	2,400
Northland School Division No. 61	2,500
Sherwood Park Catholic Sep. School District No. 105	2,800
Fort Vermilion School Division No. 52	2,900
Willow Creek School Division No. 28	3,100
Lloydminster Public School Division	3,200
Cardston School Division No. 2	3,250
County of Grande Prairie No. 1	3,360
County of Lacombe No. 14	3,400
St. Albert School District No. 3	3,500
County of Mountain View No. 17	4,160
County of Leduc No. 25	4,200
Sturgeon School Division No. 24	4,290
Yellowhead School Division No. 12	4,600
Foothills School Division No. 38	4,900
County of Red Deer No. 23	5,000
Medicine Hat School District No. 76	6,200
Red Deer Public School District No. 104	7,300
Strathcona County Board of Education No. 20	12,000

ADMINISTRATIVE COMPUTER SURVEY

	POPULATION OF JURISDICTIONS						
	1,000 TO 2,000	2,000 TO 3,000	3,000 TO 4,000	4,000 TO 5,000	5,000 TO 7,000	7,000 PLUS	GRAND TOTAL
Number of Replies	3	7	6	5	2	2	25
Number of Schools:							
Elementary	4	31	21	32	21	36	145
Junior	1	3	6	1	1	10	22
Senior	1	3	6	2	-	5	17
Combined	7	48	31	29	10	1	126
Approximate number of schools using computers for administration:							
Elementary	-	13	7	12	-	3	35
Junior	-	2	3	-	-	5	10
Senior	1	3	8	5	-	4	21
Combined	-	16	13	17	2	5	53
ELEMENTARY							
What applications are used?							
Wordprocessing	-	6	4	3	1	1	15
Spreadsheet	-	4	2	2	-	1	9
Database	-	6	4	3	1	-	14
Accounting	-	3	1	2	-	1	7
Graphics	-	1	1	-	-	-	2
Telecommunications	-	-	-	-	-	1	1
Other: Report Cards and Class Lists							

	POPULATION OF JURISDICTIONS						
	1,000 TO 2,000	2,000 TO 3,000	3,000 TO 4,000	4,000 TO 5,000	5,000 TO 7,000	7,000 PLUS	GRAND TOTAL
How are the computers used for student information management?							
Student records (demographic)	-	2	4	1	-	1	8
Student records (marks)	-	6	3	2	-	1	12
Student scheduling	-	-	2	-	-	1	2
Student attendance	-	4	3	-	-	-	7
Other: Computer Managed Instruction							
JUNIOR HIGH							
What applications are used?							
Wordprocessing	-	5	3	2	-	1	11
Spreadsheet	-	5	1	2	-	1	9
Database	1	5	1	2	-	1	10
Accounting	-	2	1	1	-	-	4
Graphics	-	2	1	-	-	1	4
Telecommunications	-	1	-	-	-	1	2
How are the computers used for student information management?							
Student records (demographic)	1	2	2	1	-	-	6
Student records (marks)	1	2	2	1	-	-	6
Student scheduling	1	1	1	-	-	-	3
Student attendance	1	2	1	1	-	-	5
Other: Report cards							

	POPULATION OF JURISDICTIONS						
	1,000 TO 2,000	2,000 TO 3,000	3,000 TO 4,000	4,000 TO 5,000	5,000 TO 7,000	7,000 PLUS	GRAND TOTAL
SENIOR HIGH							
What applications are used?							
Wordprocessing	-	5	5	5	2	1	18
Spreadsheet	-	4	3	4	2	-	13
Database	-	6	4	4	1	-	15
Accounting	-	1	3	3	-	1	8
Graphics	-	1	1	-	1	-	3
Telecommunications	-	-	2	-	-	-	2
Other: Scheduling and Reporting							
How are the computers used for student information management?							
Student records (demographic)	2	4	5	4	-	1	16
Student records (marks)	2	6	5	4	2	1	20
Student scheduling	2	3	4	4	1	1	15
Student attendance	1	4	4	3	2	-	14
CENTRAL ADMINISTRATION							
How is the administrative computer service provided?							
We use a service bureau: Datatron, IBM, MIG	2	1	1	-	1	-	5
How is the service bureau used?							
On-line	-	1	-	-	-	-	1
Batch	2	1	1	-	1	-	5
We lease	-	1	1	3	-	-	5
We own	2	5	4	2	2	2	17

	POPULATION OF JURISDICTIONS						
	1,000 TO 2,000	2,000 TO 3,000	3,000 TO 4,000	4,000 TO 5,000	5,000 TO 7,000	7,000 PLUS	GRAND TOTAL
What applications are used?							
Wordprocessing	2	6	4	4	2	1	23
Spreadsheet	-	5	5	4	2	1	17
Database	1	5	5	3	2	1	17
Accounting	1	7	6	5	2	2	23
- accounts receivable	-	5	3	5	2	2	17
- accounts payable	-	6	5	5	2	2	20
- general ledger	1	7	5	5	2	2	22
- payroll	1	6	6	5	2	2	21
- budget control	1	5	6	5	2	2	21
- construction job cost	1	3	1	-	1	-	6
Graphics	-	1	-	2	2	1	6
Telecommunications	-	1	2	-	-	2	5
Other: Capital Assets-Inventory, teacher applications, tax roll, debenture system, warehouse inventory							
How are computers used for student information?							
Student records (demographic)	-	2	-	-	1	2	5
Student records (marks)	-	1	-	1	2	2	6
Student scheduling	-	1	-	-	-	2	3
Student attendance	-	1	-	-	-	-	1
Financial management	-	2	-	2	-	2	6
Library management	-	1	-	-	1	-	2
Warehouse inventory	-	2	2	-	-	-	4
Employee records	-	2	-	1	-	1	4

	POPULATION OF JURISDICTIONS						
	1,000 TO 2,000	2,000 TO 3,000	3,000 TO 4,000	4,000 TO 5,000	5,000 TO 7,000	7,000 PLUS	GRAND TOTAL
How is computer hardware maintenance accomplished?							
We have a maintenance contract.	1	7	2	5	-	2	17
We have our own maintenance staff.	-	1	-	-	-	-	1
No maintenance contract nor staff.	1	-	4	-	-	-	5
How is computer software maintenance accomplished?							
We have a maintenance contract.	-	5	4	4	1	1	15
We have our own maintenance staff.	-	1	1	-	-	1	3
No maintenance contract or staff.	2	1	1	1	-	-	5

IBM Canada Ltd., 3500 Steeles Ave. E., Markham, Ontario, L3R 2Z1

MARKETING ANNOUNCEMENT

October 18, 1985

PARTS EXCHANGE FOR SELECTED SERVICE CENTRE PRODUCTS

Effective November 1, 1985, IBM will offer selected parts/elements, for the IBM Personal Computer family of products, on an exchange basis.

HIGHLIGHTS

- Selected parts/elements for IBM Personal Computer products will be available at an exchange price to customers who present a malfunctioning IBM part/element of the same part number, that has not been physically damaged or altered, to an IBM Parts Station or Service Centre.
- IBM will provide selected parts/elements at the exchange price for machines being serviced on an hourly basis.
- The exchange price is lower than the regular price because of the value of the malfunctioning part/element returned to IBM

WARRANTY

IBM will replace parts/elements that are found to have defects in material or workmanship within 90 days after delivery. (See INFORMATION BULLETIN FOR CUSTOMERS - SALE OF IBM PARTS Form # 2217).

PROCEDURE FOR SALE OF PARTS ON AN EXCHANGE BASIS

The provisions in the THE INFORMATION BULLETIN FOR CUSTOMERS - SALE OF IBM PARTS (Form # 2217) and the SUPPLEMENT TO THE INFORMATION BULLETIN FOR CUSTOMERS - SALE OF IBM PARTS apply to parts/elements provided on an exchange basis and include the following:

- The customer is responsible for making the malfunctioning part/element, available at the time of the exchange.
- If IBM cannot provide the part/element immediately, then normal ordering procedures will apply. During the period that the part/element is on order, the customer will keep the malfunctioning part/element.
- A part/element that has been physically damaged or altered, will not be accepted and the exchange price will not apply.

This announcement is provided for your information only. IBM's products can only be ordered under the terms and conditions of IBM's applicable agreements. For more information, contact your IBM marketing representative.

PARTS/ELEMENTS AVAILABLE ON AN EXCHANGE BASIS

PART#	DESCRIPTION	EXCHANGE PRICE
8285978	Portable PC Diskette Drive	$255.00
8285997	PC jr Diskette Drive	257.00
8286128	20 Meg. Fixed Disk	879.00
8529146	Colour Adapter	148.00
8529148	Mono/ Prt Adapter	197.00
8529152	Diskette Adapter	129.00
8529171	Monochrome Display	200.00
8529206	320/360K Diskette Drive	300.00
8529227	Colour Display	399.00
8529254	PC XT System Board	342.00
8529275	10 Meg. Fixed Disk	541.00
8529297	PC Keyboard	137.00
8654213	64/256K PC System Board	322.00
8654422	Portable Keyboard	180.00

Provincial sales tax extra. (if applicable)

Prices subject to change without notice.

LETHBRIDGE SCHOOL DISTRICT NO. 51

COMPUTER SURVEY

SCHOOL DISTRICT	POPULATION	BRAND NAME OF COMPUTER USED		NAME OF STUDENT INFORMATION
Medicine Hat School District No. 76	6200	Elem.	Nil	Nil
		Junior	Nil	Nil
		Senior	IBM - PC Apple	Columbia and Hartz
		C. Office	Local Area Network	Mark Scanning Package Media Resources Package Payroll, Accounts Payable, General Ledger, Stores Inventory, Wordstar, Lotus 1 2 3, Informix
Yellowhead School Division No. 12	4600	Elem.	Commodore Pet Mini-computer - (Radio Shack)	Nil
		Junior	Nil	Nil
		Senior	IBM-PC	Nil
		C. Office	IBM-PC	Lotus 1 2 3, Multmate
Pincher Creek School Division No. 29	1225	Elem.	Nil	Nil
		Junior	Nil	Nil
		Senior	Nil	Nil
		C. Office	Apple IBM-PC	Micro Computer Programs
Lethbridge Separate School District No. 9	2300	Elem.	Nil	Nil
		Junior	Data Centre - (on line terminal)	Datatron Processing and System Ltd. - (Student information package)
		Senior	Commodore Pet	Nil
		C. Office	Data Centre - (on line to IBM)	Nil

SCHOOL DISTRICT	POPULATION	BRAND NAME OF COMPUTER USED		NAME OF STUDENT INFORMATION
Brooks School District No. 2092	2400	Elem.	Apple	Harts, Milligan Series,
			Echo Mangut	
		Junior	Apple	Echo Mangut, Harts,
			Milligan Series	
		Senior	Apple	Harts III, IBM
			IBM-PC	Mang. Package
		C. Office	Apple	Nil
			Burroughs B-92	
Lloydminster Public School Division	3200	Elem.	Nil	Nil
		Junior	Nil	Nil
		Senior	IBM-PC	SSTA Software Package
			IBM-PC XT	
		Central	IBM-PC	SSTA - Payroll
			IBM-PC-AT	Lotus, IBM Write,
			IBM-PC	Crosstalk, PFS File &
				Report, Base III
Red Deer Public School District No. 104	7300	Elem.	DEC 2020	ETS Systems Group
		Senior	DEC 2020	ETS Systems Group
			VT100's LA120 at school with direct line to mainframe	
		C. Office	Mainframe DEC 2020	Personnel/payroll system Budgeting and accounting system Aries information systems
Sturgeon School Division No. 24	4290	Elem.	Apple	Nil
		Junior	Nil	Nil
		Senior	Mini-computer	Student Information Retrieval
			Altos	System
		C. Office	Apple	Management Information
			IBM-PC	Group
			Mini-Computer - (N.C.R. 8250-8271)	

SCHOOL DISTRICT	POPULATION	BRAND NAME OF COMPUTER USED		NAME OF STUDENT INFORMATION
County of Red Deer No. 23	5000	Elem.	Apple	Nil
		Junior & Senior	Apple	Nil
		C. Office	Apple Mainframe - (IBM 8250)	Nil
County of Wetaskiwin No. 10	2200	Elem.	Apple	Nil
		Junior	Apple	Nil
		Senior	Apple	Nil
		C. Office	Apple IBM 34	Applewriter Appleworks
County of Wheatland No. 16	3200	Elem.	Apple	Nil
		Junior	Apple	Nil
		Senior	Apple	Nil
		C. Office	Apple Mini-Computer - (Burroughs, IBM)	Nil
Cardston School Division #2	3250	Elem.	Apple	Harts III
		Junior	Apple	Harts III
		Senior	Apple	Nil
		C. Office	IBM-PC	Custom-Designed Using a Cosmos - Database pkg. Revelation
County of Mountain View	4160	Elem.	Apple Cannon VP 2000 - (Word Processing)	Nil
		Junior	Apple Cannon VP 2000	Nil
		Senior	Apple Cannon VP 2000	Nil
		C. Office	Apple - (MacIntosh) Data General - (Mainly for Financial Purposes)	Developed for our purposes by a Software House

SCHOOL DISTRICT	POPULATION	BRAND NAME OF COMPUTER USED		NAME OF STUDENT INFORMATION
St. Albert School District No. 3	3500	Elem.	Apple	Nil
		Junior	Nil	Nil
		Senior	Mini-Computer - (Altos)	Student Information Systems From Management Information Group
		C. Office	Mini-Computer	Packages From M.I.G.
County of Lacombe No. 14	3400	Elem.	Nil	Nil
		Junior	Nil	Nil
		Senior	Mini-Computer - (Altos 486-20)	Nil
		C. Office	Apple Mini-computer - (TI) Mainframe - (NCR 8200)	Nil
Northland School Division No. 61	2500	Elem.	Apple	Nil
		Junior	Apple	Nil
		Senior	Apple	Nil
		C. Office	NCR DM 5 Mini-Computer - (NCR 9300) Micom Word Processing Model 2001E & 3004	Student Information Retrieval Package
Stettler School District No. 1475	1300	Elem.	Nil	Nil
		Junior	Nil	Nil
		Senior	Apple	Harts
		C. Office	Word Processor - (Canon)	Nil
County of Grande Prairie No. 1	3360	Elem.	Apple	Nil
		Junior	Apple	Nil
		Senior	Apple Altos	
		C. Office	Apple Mainframe - (Basic 4)	Nil

SCHOOL DISTRICT	POPULATION	BRAND NAME OF COMPUTER USED		NAME OF STUDENT INFORMATION
Sherwood Park Catholic Separate School District No. 105	2800	Elem.	Apple	Nil
		Junior	Apple	Nil
		Senior	Apple Commodore Pet	Nil
		C. Office	Apple IBM-PC Mini-Computer - (IBM Systems 34)	PH Feddonrow Package
Foothills School Division No. 38	4900	Elem.	Nil	Nil
		Junior	Nil	Nil
		Senior	IBM-PC Mini-Computer - (NCR - Tower)	MIG SIRS Package
		C. Office	Commodore Pet IBM-PC Mini-computer - (NCR 19020)	Nil
County of Athabasca No. 12	1882	Elem.	Nil	Nil
		Junior	Apple	HARTS
		Senior	Apple	HARTS
		C. Office	Apple	Apple Writer IIe Quick File IIe

THE USE OF COMPUTERS IN BUSINESS EDUCATION
IN ALBERTA

Sharon Prather

Alberta Education
Education Consultant
Business Education

PREFACE

The purpose of this paper is to present an overview of how computers are integrated within the Alberta business education program. The focus of the information is upon curriculum development and implementation at the provincial level. Specifics regarding what is happening at the school or school system level are not included.

An outline of the business education program, structure of the revised curriculum, and specifics with respect to the integration of computers are presented. The paper concludes with personal comments on concerns and questions which affect the revised program, and possible directions for future programs.

THE USE OF COMPUTERS IN THE ALBERTA BUSINESS EDUCATION PROGRAM

The goal of the business education program in Alberta is to help students develop:

1. skills and knowledge all citizens need to participate successfully in the business world,
2. skills for immediate job entry, and
3. skills and knowledge supportive of a business-related post-secondary program.

This goal demonstrates why it is important that the business education program responds to the needs of business and reflects business procedures and standards, if it is to remain relevant and credible.

Over the past decade, the computer revolution has had dramatic impact on how business functions. We have seen the business world move from the use of mainframe computers operated by a computing specialist, to interactive main frame, mini and microcomputer applications that now involve the majority of the employees of a business enterprise.

In order to compete in a steadily reducing and increasingly competitive job market, our students, as potential employees or as future entrepreneurs, must become adept in the use of computer-related applications. They must be familiar with computer-related terminology, understand the power and potential of the computer, and be confident that they can manipulate the technology to meet their personal and career goals.

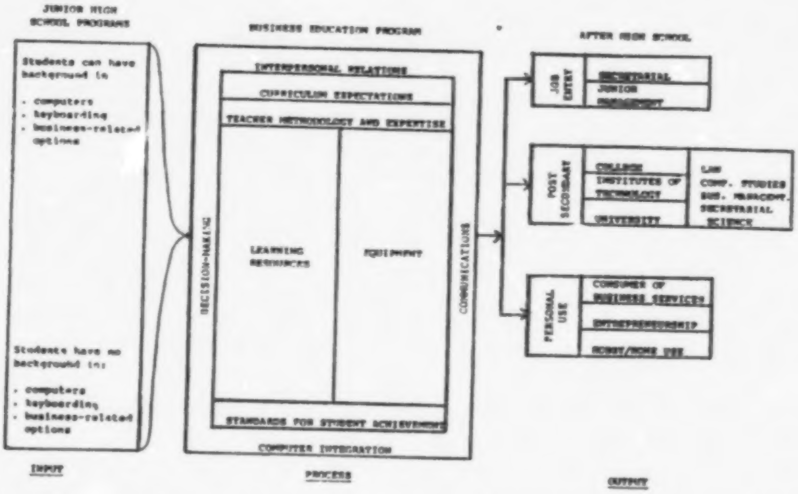
In addition, and perhaps more important, our students must feel comfortable with technology; comfortable that they can adapt to the rapid changes which characterize the computer revolution; and comfortable that their basic skills will provide a sound foundation for the learning which will continue long after their formal schooling is completed.

The importance of building computer skills and knowledge should, however, be kept in proper perspective. It is equally important for students to be able to make effective decisions, to work in a productive, efficient, and cooperative manner, and to communicate effectively with others.

THE BUSINESS EDUCATION PROGRAM

The business education program is available primarily at the high school level. It is a flexible program which is responsive to the varying related option courses which are available at the junior high level, as well as to the varying aspirations of students when they leave high school.

Within the broad category of business education are eight separate, yet related, subject areas. Although the general objectives of the subject areas are related, the content is unique and often requires specific instructional strategies. Expectations for student achievement reflect the orientation (skill development or theory emphasis; vocational or personal use) of the course objectives. The following diagrams these relationships.



JUNIOR HIGH SCHOOL PROGRAMS
BUSINESS EDUCATION PROGRAM
AFTER HIGH SCHOOL
Students can have background in
- computers
- keyboarding
- business-related options
Students have no background in:
- computers
- keyboarding
- business-related options
INTERPERSONAL RELATIONS
CURRICULUM EXPECTATIONS
TEACHER METHODOLOGY AND EXPERTISE
DECISION-MAKING
LEARNING RESOURCES
EQUIPMENT
COMMUNICATIONS
STANDARDS FOR STUDENT ACHIEVEMENT
COMPUTER INTEGRATION
JOB ENTRY
SECRETARIAL
JUNIOR MANAGEMENT
POST SECONDARY
COLLEGE
INSTITUTES OF TECHNOLOGY
UNIVERSITY
LAW
COMP. STUDIES
BUS. MANAGEMT.
SECRETARIAL SCIENCE
PERSONAL USE
CONSUMER OF BUSINESS SERVICES
ENTREPRENEURSHIP
HOBBY/HOME USE
INPUT
PROCESS
OUTPUT

By ensuring that the content is relevant; by establishing appropriate expectations for student achievement; by maintaining a learning environment which reinforces business procedures and principles; and by providing opportunities to make decisions and to produce quality work in an efficient manner, students can build their skills and become increasingly confident in their ability to be successful in the world of work.

THE REVISED CURRICULUM

To respond to the challenges presented by the goals of the program and the business environment, the business education program has undergone an extensive curriculum revision. The major focus of this revision was:

1. To provide appropriate computer integration throughout the program, particularly in courses which prepared students for secretarial and junior management careers;
2. To provide an opportunity for all students, at all levels of ability, to learn to use computers as a tool, and
3. To revise the content to reflect current business practices and procedures.

Following a four-year development period, nine curriculum guides, involving 27 courses, were approved by the Minister of Education for mandatory implementation September 1985:

Accounting 10, 20, 30 Curriculum Guide
Basic Business 20, 30 Curriculum Guide
Computer Processing 10, 20, 30 Curriculum Guide
Law 20, 30 Curriculum Guide
Marketing 20, 30 Curriculum Guide
Office Procedures 20, 30 Curriculum Guide
Shorthand 20, 30 Curriculum Guide
Typewriting 10, 20, 30 Curriculum Guide
Business Education 10, 20, 30 Curriculum Guide
(This guide includes a number of modules which can be used for enrichment within the courses listed above as well as the following 3-credit courses):

-Recordkeeping 10
-Business Calculations 20
-Business Communications 20
-Dictatyping 20
-Word Processing 30

The nine curriculum guides are organized into modules, each of which requires approximately 25 hours of instructional time. Within each curriculum guide certain modules are designated **core**, the remaining modules are designated **elective.** Each module focuses on a specific objective, outlines the topics to be covered within the module, and suggests various learning tasks for each topic.

(Appendix A provides a matrix of the business education courses and modules. For more specific details regarding the program structure, refer to the particular curriculum guide and the Business Education Manual for Administrators, Counsellors and Teachers).

COMPUTER INTEGRATION WITHIN THE REVISED CURRICULUM

The revised business education program integrates computers in three basic ways:

1. Students learn ABOUT computers in courses such as Computer Processing 10-20-30, Office Procedures 30 and Word Processing 30. Students learn how to program computers in one or more programming languages, how computers can communicate, and how to use such productivity software as word processors, data bases, and electronic spreadsheets.
2. Students learn ON computers through data input and information manipulation in courses such as Typewriting 10-20-30, Office Procedures 20-30, Marketing 20-30, Accounting 10-20-30 and Shorthand 20-30.
3. Students learn WITH computers when software appropriate for drill and practice, remediation, or enrichment is available.

Computer-related functions are integrated throughout the business education courses. (Appendix B outlines these functions and identifies the courses in which these concepts are explicitly addressed.)

Using the computer as an instructional tool will help business educators meet the needs of individual students. At this point, quality software is not readily available for computer assisted instruction, but is becoming accessible. The selection of productivity software is extensive and is, in general, of high quality.

As is typical in most optional courses, there is a wide range in students' ability, motivation, and career aspirations. Through more individualized instruction and access to remedial or challenge material, teachers may well be able to use computers to address student needs more effectively and to encourage mastery of basic skills and content. In addition, as in other courses, business educators use computers for administrative tasks such as marks calculation.

IMPLEMENTING THE REVISED PROGRAM

Successful implementation of the revised program involves a number of additional factors which have been, and are in the process of being, addressed by Alberta Education, by school systems throughout the province, by professional associations, and by individual teachers:

- planning the program
- obtaining equipment
- upgrading facilities
- obtaining learning resources
- inservicing teachers

Planning the Program

The modular format used in the business education program provides an opportunity for schools to plan programs which meet the needs of the students, to take advantage of teacher expertise, and to utilize the resource and facility support available within the school.

This opportunity to decide the program content requires teachers and administrators to make short-range and long-range plans and to decide which courses will be offered, which modules selected, as well as how much courses and modules will be timetabled.

By selecting modules at the school or school system level, computer courses can be designed to meet the needs of students:

1. Who have more interest in and will be more successful in learning to use the various productivity packages, but have difficulty with intermediate and advanced programming concepts;

2. Who want to learn how computers work and who have the ability to learn programming languages and other specialized programming functions; and

3. Who have a strong computer background when entering high school, either through instructional programs they have taken in elementary and junior high school or through private study, and wish to use the computers in more sophisticated applications than are available within the standard curriculum.

To respond to the evolving and specialized needs, schools can tailor the courses to the students' needs by:

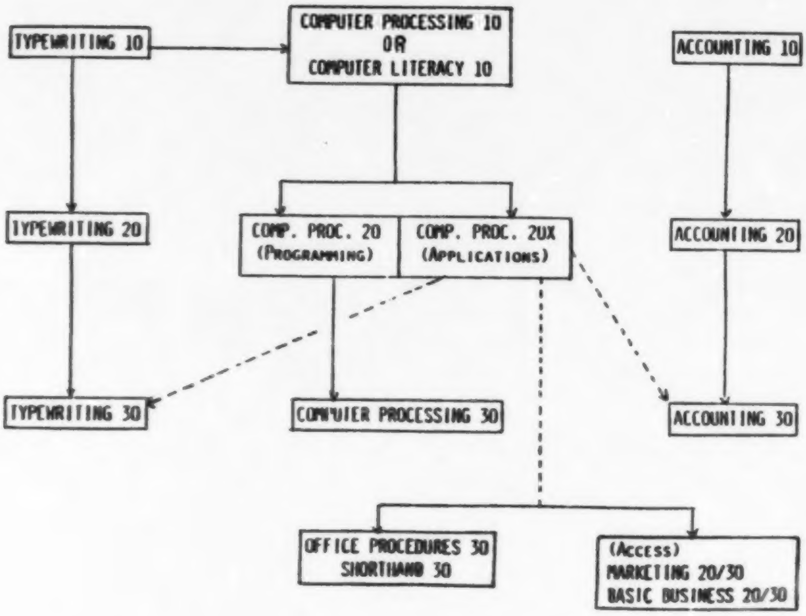
1. Selecting appropriate modules from the subject strand and/or the optional strand;

2. Providing alternate resources (i.e. advanced word processing software; programming in a second (third) language; and

3. Offering alternative courses designed for specific groups.

Many courses in the high school program deal with computers. It is important that the programs complement, not duplicate, each other. High school courses such as math, science, social studies, language arts, music and art are also integrating computers. These courses could take advantage of the complementary nature of business education courses. Skills taught in courses such as computer processing and typewriting can provide basic computer orientation and skill in the use of software such as word processors and spreadsheets which may be used in other subject areas.

Equally important as the complementary nature of the computer and typewriting programs with existing curricula is their proper sequencing within the business education courses. For example, instruction of keyboarding (Typewriting 10) should precede work on productivity software and computer programming (Computer Processing 10); instruction of software application packages such as word processors, data bases and spreadsheets should occur before students use these packages in Office Procedures 30, Accounting 20-30, or Typewriting 20-30. The following diagram outlines how computer courses may relate to other business education programs in a complementary fashion.


TYPEWRITING 10
COMPUTER PROCESSING 10
OR
COMPUTER LITERACY 10
ACCOUNTING 10
TYPEWRITING 20
COMP. PROC. 20
(PROGRAMMING)
COMP. PROC. 20X
(APPLICATIONS)
ACCOUNTING 20
TYPEWRITING 30
COMPUTER PROCESSING 30
ACCOUNTING 30
OFFICE PROCEDURES 30
SHORTHAND 30
(ACCESS)
MARKETING 20/30
BASIC BUSINESS 20/30

The Computer Processing 10-20-30 program, in particular, benefits from a modular approach. As suggested earlier, such an approach offers teachers and administrators flexibility in their curriculum planning. Of the eighteen modules that are available, one module is core, six have a software emphasis, five introduce or continue programming language skills, three offer a second (or third) programming language, and three offer specialized programming functions.

As well, modules from the Business Education 10-20-30 Curriculum Guide can be accessed for additional emphasis on research, simulations, and word processing. (The flowchart of modules for Computer Processing 10-20-30 is provided in Appendix C.)

Obtaining Equipment

Timely support for the goals of the revised curriculum was provided when the Minister of Education announced the expansion of the Building Quality Restoration Program (BQRP) to include a Business Education Equipment Upgrading Project. This three year matching grant has provided Alberta high schools with over $53 million to upgrade the business education labs. This grant acknowledges that a key element to the success of the program revision is access to suitable hardware.

As anticipated, the majority of the purchases to date have been computers. A broad view of the increase in student access to computers is available in the "Survey on Computers in Schools" conducted by Dr. Milt Petruk for the Media and Technology Branch of Alberta Education.

Within the curriculum guides developed during the revision, the choice of type of equipment, brand of equipment, and the equipment configuration are not specified. However, recommendations as to the student work-station ratios and software requirements are noted. The equipment lists which accompany the BQRP Business Education Equipment Upgrading Project also indicate recommended ratios. (This equipment list is attached as Appendix D.) It should be noted that many school systems had made significant investments in computers for business education labs prior to the grant announcement.

Upgrading Facilities

With this increased access to new equipment, many classrooms and business education labs require modernization. Support for this is available through the BQRP Modernization Program of the School Buildings Branch, Alberta Education.

The following outlines a number of points to be considered by schools when upgrading an existing business education lab. (Additional information on upgrading or establishing a computer lab is available in "Planning and Designing School Computer Facilities" prepared by Alberta Education School Buildings Branch.)

1. Determine how the lab will be used. If the lab is to be used for theory instruction as well as skill building, desks will need to provide adequate space for notetaking and bookwork as well as for the equipment and related peripherals. The "L-shaped" desks are considered effective in providing for both activities. Alternatively, an adjoining instructional area separated from the lab area could be provided for theory instruction.

In addition to software suitable for computer assisted instruction, the Clearinghouse focus is on identifying applications (productivity) software for:

1. word processing
2. electronic spreadsheet
3. database
4. general ledger

At this time, a number of word processing packages in Apple and IBM format have been approved as recommended learning resources for business education and are available through the School Book Branch with normal discount. At this time only Appleworks is approved as a basic resource. (Refer to Appendix F for a summary of how the applications software is integrated into the business education courses along with examples of packages available from the School Book Branch and in use in business education classrooms.)

A project to identify additional productivity software and to obtain even more attractive discounts is underway. This review, contracted through the Alberta Education's Media and Technology Branch, is focusing on word processing, database, spreadsheet, integrated, communications, and windowing software packages.

Teacher Inservice

The revision to the curriculum, accompanied by the integration of computers, has provided exceptional challenge to business education teachers. Over the past two or three years they have been faced with continuing changes with respect to:

- Expectations of the revised curriculum guides,
- Use of the new equipment, particularly computer hardware,
- Use of numerous software packages, and,
- Use of newly-approved learning resources.

Traditional instructional methodology in business education labs has been replaced by classes characterized by "multi-tasking" -- classes in which concurrent activities, group work, individualized instruction, and a variety of learning resources and equipment are effectively coordinated.

In addition to regular responsibilities, business educators have invested many hours in researching and testing hardware and software, preparing for facility modifications, as well as setting up and handling maintenance of the equipment. Much of this activity has been to prepare themselves to use the new equipment and to implement the new curriculum, much has been to provide advice regarding expenditures to their school systems.

Some inservice assistance has been provided through local school systems, professional associations and Alberta Education. Much of the professional upgrading has been handled by teachers on an individual basis.

The need for inservice will continue as the program responds to hardware changes, software revisions, and changes in the business world. Inservice programs must also answer the needs of teachers not previously engaged in business education courses but who are now involved.

CONSIDERATIONS FOR THE FUTURE

The Secondary Education Review provides the framework for the future of secondary education over the next decade. One of the Goals of Secondary Education focuses on the objectives of the business education program.

> "Education should help students recognize, make and act on good choices. Within this broad aim, the goals of secondary schools are to assist students to:
>
> > become aware of the expectations, and to be prepared for the opportunities of the workplace -- expectations that will be faced as employees or employers; expectations that will be faced as entrepreneurs of volunteers;" (Secondary Education in Alberta Policy Statement, June 1985, page 13.)

In addition, the business education program will be particularly responsive to the Secondary Education Review goal of encouraging partnership with business and the community.

The present business education program is scheduled for review and revision, as necessary, in 1988. This review will assess the program in terms of the goals and principles outlined in the Secondary Education Review. Also, the review may well provide an opportunity to evaluate how effectively the revised program has met the needs of Alberta students.

Even during this early stage of curriculum implementations, there are indications of program changes.

1. We may well find that the names of certain courses are no longer appropriate. For example, it is more accurate to refer to shorthand as notetaking; typewriting as keyboarding; and office procedures and word processing as information processing.

2. Time allocated to certain objectives and topics will need to be modified. For example, telecommunications may soon need additional instructional time and resource support, computer programming less.

3. Courses which develop managerial and entrepreneurial skills will be in more demand and expanded resource support and teacher preservice and inservice programs will need to be available.

Perhaps the most exciting aspect of the business education program is its dynamism. The changes that impact the business world and our society can also affect future business education programs. For example:

1. The emphasis on the computer as a unique learning experience will continue to decrease and computers will be integrated within schools, businesses, and homes as a productivity tool as common, and as easy to use, as the telephone or the overhead projector. The business education program will eventually need to respond to these changes by modifying, or perhaps eliminating courses such as computer processing.

2. Schools will be able to combine the power of satellites, laser disks and computers to produce high quality, interactive, instructional programs. This will benefit small schools which at present can offer only a limited option program. Courses with limited enrolments such as Marketing 30 or Shorthand 30 could be offered from a central source and be distributed throughout the province. These courses could be "canned" or interactive.

3. Professional business and service groups will be increasingly willing to join in partnership in the education of our students. Other government agencies are also increasing their support for the program. Business educators have long taken advantage of the expertise available within the business community, and many business education students have been involved in work study and work experience programs. Opportunities to expand this input cannot help but benefit the program and the vocational oriented courses in particular.

4. Interaction via telecommunication systems between students in other cities, provinces, and countries will become commonplace. The concept of building personal networks which may be used to share ideas, information, and solutions will continue to expand. For business education students, this will provide an opportunity to simulate how business communicates, markets, and makes decisions.

5. There will be an increase in the number of decisions and in the complexity of the problems. Information bases as well as on-site storage capacity available for student use will increase the amount of data which must be considered. Consequently, skills in interpreting and manipulating information and in making decisions will need to become even more sophisticated. Business education courses can use technology to provide students with experience in making decisions which simulate business activities.

There are many questions which are of immediate concern to business educators and administrators responsible for business education programs. Many of these questions cannot be answered fully until we have had the opportunity to work with the technology and to evaluate the educational implications. Some of these are:

1. How can we ensure continued availability of appropriate technology within the classrooms?

2. What is the future of typewriting? At what grade level should it be taught? By whom? On what type of equipment? How long will keyboards be necessary for data input?

3. How can curriculum relevance be ensured? How frequently should the program be revised?

4. How can teachers remain current with respect to business procedures and standards?

5. How can schools obtain suitable, up-to-date learning resources (print and software)? When will tutorial materials appropriate for instruction of productivity software packages be available?

6. How do business education programs articulate with post-secondary programs? What opportunities do students have for advanced standing or preference during selection?

7. How can business education courses establish standards for student achievement that provide employers and post-secondary institutions with an accurate, consistent indicator of student background and skill?

8. How can the time spent by business educators on non-instructional activities (maintenance of machines, inventory, ordering and stocking of supplies, etc.,) be reduced?

Solutions to these and other questions will demand the cooperative efforts of teachers, school administrators, school systems, Alberta Education, business and post-secondary institutions.

CONCLUDING COMMENTS

Since 1904 the business education program has been an important part of the education of Alberta students. This tradition will continue. The changes to the curriculum, access to grant funds for hardware acquisition, increased public interest in computers, and increased career opportunities within business have raised the profile of the business education programs within the school systems and increased the involvement of business educators in curriculum and purchase decision-making.

The extent of the curriculum implementation is indeed indicative of the high standards of competence, flexibility, and the professional attitude of Alberta's business educators and school system administrators who have responded so positively to these massive changes.

However, the business education program in Alberta has undergone so much change over such a short time that a period of consolidation is necessary. Teachers and schools now need time to integrate and effectively utilize computers. It is important that ongoing activities focus on supporting the curriculum implementation and the computer integration by coordinating available resources, developing additional resources, improving the learning environment, establishing expectations for student achievement and increasing teacher expertise.

MATRIX

Appendix A-1

SUBJECT STRANDS

(13)* ACCOUNTING

C 1. Basic Accounting Concepts
C 2. Journalizing and Posting
C 3. Completing the Accounting Cycle
C 4. Merchandise Accounting
C 5. End-of-Year Adjustments & 8-Column Worksheets
E 6. Optional Accounting Tasks
E 7. Voucher System and End-of-Year Adjustments
E 8. Departmentalized Tasks
E 9. Partnership and Corporation Accounting
E 10. Cost Accounting
E 11. Financial Analysis
E 12. Accounting Simulation I
E 13. Accounting Simulation II: Computerized Accounting

(10)* BASIC BUSINESS

BB 20
C 1. Canadian Business
C 2. Consumer Credit
C 3. Insurance

BB 30
C 4. Economic Concepts
C 5. Small Business Management I
C 6. Management Techniques

ELECTIVE
E 7. Personal Financial Planning
E 8. Small Business Management II (Simulation)

(15)* COMPUTER PROCESSING

C 1. Computer Information Systems
E 2. Overview of Software
E 3. Applications: Data Entry
E 4. Applications: Word Processing
E 5. Applications: Computer Simulations
E 6. Applications: Data Base
E 7. Applications: Electronic Spread Sheet
E 8. Overview of Introductory Programming Language
E 9. Fundamentals of Input/Output
E 10. Introduction to Advanced Computer Programming Techniques
E 11. Advanced Computer Programming Techniques
E 12. Extended Programming Project
E 13. Introduction to Second Programming Language
E 14. Applications in Second Programming Language
E 15. Extended Project in Second Programming Language
E 16. Graphics
E 17. Systems Analysis and Program Development
E 18. Machine/Assembly Language

(10)* LAW

LW 20
C 1. Nature of Law and the Civil Law System
C 2. Contract Law
C 3. Family Law

LW 30
C 4. Basic Rights and Responsibilities
C 5. Labour Law
C 6. Property Law

ELECTIVE
E 7. Criminal Justice System
E 8. Consumer Law
E 9. Tort Law
E 10. Controversial Issues

(10)* MARKETING

MK 20
C 1. World of Marketing
C 2. Advertising and Sales Promotion
C 3. Distribution of Goods and Services

MK 30
C 4. Marketing Research
C 5. Pricing and Financial Activities
C 6. Selling

ELECTIVE
E 7. Display
E 8. Purchasing & Controlling Merchandise

(10)* OFFICE PROCEDURES

C 1. Structure of the Business Office
E 2. Personnel in the Business Office
E 3. Business Communication
E 4. Records Management
E 5. Information Processing
E 6. Clerical Routines
E 7. Secretarial Routines
E 8. Office Specialties I
E 9. Office Specialties II
E 10. Office Simulation

(10)* SHORTHAND

C 1. Shorthand Theory 1
C 2. Shorthand Theory 2
C 3. Shorthand Theory 3
E 4. Shorthand Theory, Dictation & Transcription 1
E 5. Shorthand Theory, Dictation & Transcription 2
E 6. Speed & Transcription Skill Building 1
E 7. Speed & Transcription Skill Building 2
E 8. Speed & Transcription Skill Building 3
E 9. Speed & Transcription Skill Building 4
E 10. Speed & Transcription Skill Building 5

(15)* TYPEWRITING

C 1. Keyboarding
C 2. Keyboarding, Centering and Tabulation
C 3. Letters and Essays
C 4. Reports
C 5. Letters & Tables
C 6. Manuscripts
C 7. Tables, Business Forms & Financial Reports
C 8. Business Correspondence
E 9. Specialized Prod. Applications
E 10. Production Projects & Review
E 11. Professional Applications I
E 12. Professional Applications II
E 13. Simulation I
E 14. Simulation II

OPTIONAL

OPTIONAL

Subject to restrictions noted in the curriculum guides, these optional modules may be used to enhance the subject strand courses.

1. Record Keeping 1
2. Record Keeping 2
3. Record Keeping 3
4. Business Calculation 1
5. Business Calculation 2
6. Business Calculation 3
7. Business Communication — Development
8. Business Communication — Practice
9. Business Communication — Integration
10. Business Research Project
11. Goal Setting and Career Development
12. Dicta Typing 1
13. Dicta Typing 2
14. Word Processing 1
15. Word Processing 2
16. Business Simulation

MINI COURSES

(3)* RECORD KEEPING 10	(3)* BUSINESS CALCULATION 20	(3)* BUSINESS COMMUNICATION 20
C 1 Record Keeping 1	C 1 Business Calculation 1	C 1 Business Communication — Development
C 2 Record Keeping 2	C 2 Business Calculation 2	C 2 Business Communication — Practice
C 3 Record Keeping 3	C 3 Business Calculation 3	C 3 Business Communication — Integration

(3)* DICTA TYPING 20	(3)* WORD PROCESSING 30
C 1 Dicta Typing 1	C 1 Word Processing 1
C 2 Dicta Typing 2	C 2 Word Processing 2
C 3 Business Simulation	C 3 Business Simulation

BUSINESS EDUCATION 10-20-30

(30) BUSINESS EDUCATION 10-20-30

Modules from any of the 8 subject strands, and/or the Optional strand may be combined to form three, five or ten credit courses at the 10, 20 or 30 level. The courses are sequential. Elective modules may only be included in a program when core modules have been completed. Care should be taken to ensure that student programs do not duplicate modules.

***Refers to maximum credits available.**

Note: Core modules are prerequisite to elective modules.

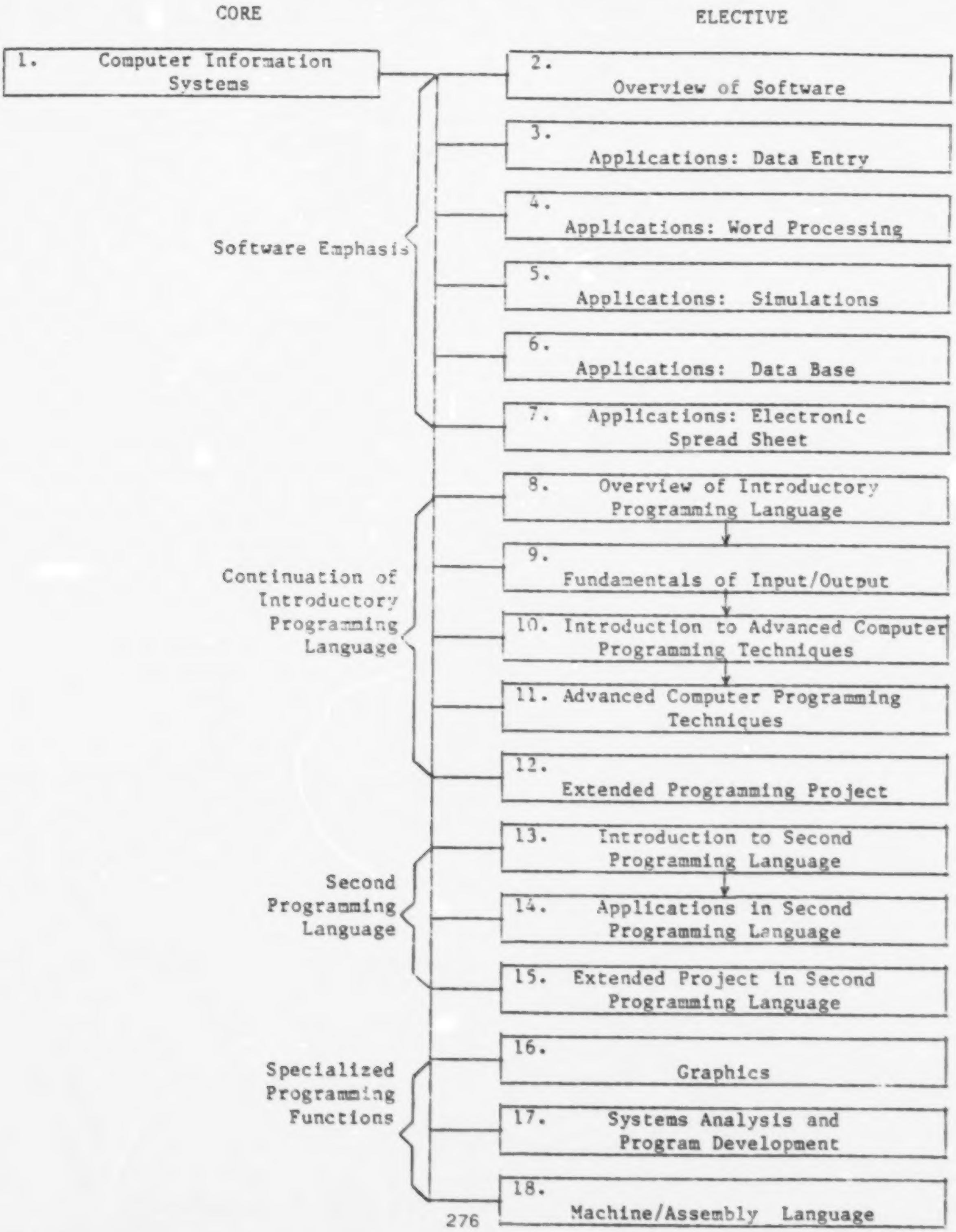
Code: C — Core
E — Elective

Appendix B

COMPUTER-RELATED TOPICS/FUNCTIONS INTEGRATED WITHIN BUSINESS EDUCATION PROGRAM

FUNCTIONS	INCLUDED IN COURSES/MODULES
Keyboarding - introduction to touch "typewriting"	Typewriting (Modules 1-3)
Typewriting - speed and accuracy skill development	Typewriting (Modules 1-14)
Production of letters, reports, tables, forms	Typewriting (Modules 3-14) Office Procedures (Modules 8-10) Word Processing 30 Shorthand (Modules 4-10)
Programming in BASIC*	Computer Processing (Modules 8-12)
Programming in other languages*	Computer Processing (Modules 8-12, 13-15, 18)
Programming with graphics	Computer Processing (Module 16)
Systems analysis	Computer Processing (Module 17)
Word Processing - personal use - professional	Typewriting (Modules 1-3) if on computers Computer Processing (Module 4) Typewriting (Modules 3-14) if on computers Office Procedures (Modules 8-10) if on computers Word Processing 30 (must be on computers) Shorthand (Modules 4-10) if on computers
Data Base	Computer Processing (Module 2, 5) Basic Business Marketing
Spreadsheet	Computer Processing (Module 2) Accounting (Modules 6, 7-13)
Accounting (General Ledger)	Accounting (Modules 6-13)
Telecommunications - Electronic Mail - Bulletin Boards - External Data Base	Computer Processing Office Procedures Typewriting Basic Business Marketing Law
Simulations - Management Decisions - Economic Choice - Budget	Marketing Basic Business Accounting Computer Processing

FLOWCHART OF MODULES


CORE
ELECTIVE
1. Computer Information Systems
2. Overview of Software
3. Applications: Data Entry
4. Applications: Word Processing
5. Applications: Simulations
6. Applications: Data Base
7. Applications: Electronic Spread Sheet
Software Emphasis
8. Overview of Introductory Programming Language
9. Fundamentals of Input/Output
10. Introduction to Advanced Computer Programming Techniques
11. Advanced Computer Programming Techniques
12. Extended Programming Project
Continuation of Introductory Programming Language
13. Introduction to Second Programming Language
14. Applications in Second Programming Language
15. Extended Project in Second Programming Language
Second Programming Language
16. Graphics
17. Systems Analysis and Program Development
18. Machine/Assembly Language
Specialized Programming Functions

BCRP BUSINESS EDUCATION/CODE LIST

Maximum No. of Units						Code No.	Description
MP	AC	CP	MK	OP	TY		
25			1	25	25	910	Typewriters - electric/electronic. AND/OR
25	12	25	1	25	25	911	Microcomputer Unit* with CPU (64K minimum), monitor, (capacity for 80-column character display), specified firmware. Dual disk drive and/or hard disk with back-up facility. AND/OR 911.1 Dual Disk Drive 911.2 Hard Disk Drive 911.3 Monitor 911.4 Firmware
25				25	25	912	Typewriter - electronic with memory, AND/OR
2				2		913	Word Processing (stand alone) with suitable work station and software
25	12	25	2	25	25	914	Specialized Work Station (desk) complete with power bar, work space (78 cm in height) and run off for computer or typewriter (68 cm in height)
25	12	25	2	25	25	915	Chairs, swivel, posture support, adjustable height
1	1	1		1	1	916	Network System
1	1	1		1	1	917	Demonstration Monitor with stand
8	3	6	1	8	8	918	Printer Unit* with sound cover and printer work station with paper storage
12	25		12			920	Calculators - electronic, dual display with memory
1		1				921	Modem/Multiplexer
2		2				922	Graphics Tablet
1			2			923	Cash Registers with Optical Scanner and facility to communicate with microcomputer
1			1			924	Video Camera and Cassette Recorder
25	25	25				925	Number Pads (if not available on code No. 911)
				1		926	Light Table
				1		927	Photocopier with collator
				1		928	Demonstration secretarial desk, single pedestal with return
1				1		929	Demonstration file cabinet with guides, charge out cards, file wallets
25				25		930	Transcription Unit (4 with dictation facility)

MP-Multi-purpose lab
AC-Accounting lab
CP-Computer Processing lab
MK-Marketing lab
OP-Office Procedures lab
TY-Typewriting lab

* Components of the package may be purchased separately in order to upgrade present equipment to the maximum number of units shown.

CLASSROOM SCHEDULING

WORD PROCESSING LAB	SH 30 OP 20/30 TY 30 WP 30 DT 20	Filing systems, Telephone Units, Microcomputers with Word Processing software AND/OR Dedicated Word Processing AND/OR Electronic Typewriters, Information Processors, Dictation Equipment (Model Office)
INFORMATION PROCESSING LAB	CP (Appl.)	Microcomputers with WP/DB/ESS/GL modem
INTRODUCTORY COMPUTER LAB	CP/CL	Microcomputers
SENIOR COMPUTER PROCESSING LAB	CP (prog.)	Microcomputers (Advanced Languages) (Graphics) (Modem) (Robotics)
THEORY	LAW 20/30 BASIC BUSINESS 20/30) ACCOUNTING 10) MARKETING 20/30)	Access to Computer Labs (adjacent) (Labs, Stores)
KEYBOARDING LAB	TYPEWRITING 10	Electronic Typewriters OR Computers with Word Processing

APPLICATIONS SOFTWARE INTEGRATED WITHIN REVISED BUSINESS EDUCATION PROGRAM

Appendix F

		Integrated into the Curriculum in:		
Function	Software in Use in Classrooms	Subject Area Strand	Required for Modules	Recommended for Modules*
1. Word Processing	Listed in SB Branch Touchtype Format II (Enhance) Screenwriter II Apple Writer II (E) Not listed but in use Word Pro 4 Paper Clip Wordstar Word Perfect Display Write Easy Writer Multimate	Computer Processing		All (8-14 in particular)
		Office Procedures	14. Word Processing 1 15. Word Processing 2	1, 2, 3, 6, 8, 9, 12, 13
		Shorthand		3 - 10
		Typewriting		3, 5 - 10
		Optional	4. Applications: Word Processing	2
2. General Ledger Accounting	Listed in SB Branch Automated Accounting Microcomputer Oriented Accounting Not listed but in use BPI General Ledger Cas Accounting	Accounting	13. Accounting Simulation II 6. Optional Accounting Tasks (Topic 5)	4 - 13
		Basic Business		4, 5, 8
		Marketing		2, 7
3. Electronic Spread Sheet	Listed in SB Branch Visicalc Not listed but in use Calc. Result Lotus 1-2-3 Multiplan Supercalc	Accounting		4 - 13
		Basic Business		2, 4, 7
		Computer Processing	3. Applications: Data Entry 7. Applications: Electronic Spread Sheet	2, 5
4. Data Base	Listed in SB Branch Not listed but in use PC File DB Master The Manager (Oracle) DBase II, III	Basic Business		1, 5, 6, 7, 8
		Computer Processing		3, 4, 5, 6, 7
		Office Procedures	6. Applications: Data Base	1, 2, 5
		Optional		8, 9
5. Integrated Packages	Listed in SB Branch Appleworks Not listed but in use Ability Framework	Suitable Support for Word Processing, Data Base, Electronic Spreadsheet	See above	See above

* CAI and/or work station